RETINOMAX

Repair Manual

Nikon Corporation

INSTRUMENTS QUALITY ASSURANCE & ENGINEERING SEC.
OPHTHALMIC INSTRUMENTS DEPT.

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1 Introduction

1-1 Features of Retinomax

1) Retinomax can be carried easily since it is very small and light and does not have any power cable.
2) Measurement can be taken in any position. Therefore, examiner need not move their positions.
3) It takes only 0.005 seconds to take measurement and 0.2 to display measurement data.
4) Instead of the measurement start button, Retinomax provides the instantaneous alignment function which allows automatic measurement.

2 Product Overview

2-1 General Specification

Main body

Measurement range	S+C : -18D to +22D (0.25D step) C : -8D to +8D (0.25D step) AX : 1 to 180 (1 step)
Minimum measurable pupil diameter	: ø2.7 mm
Vertex Distance (VD)	:0/12/13.5/13.75/14.0/15.0/16.0
Measurement time	:0.005 sec (only for measurement) 0.2 sec (from measurement start to measurement data display)
Maximum time for continuous measurement	:1 hour when the battery is fully charged
Auto shut-off	:Turns off the power automatically if no data is entered to the equipment for 3 minutes.
Eyepiece/Display	:0.6-inch view finder
Output	:External printer (through infrared lay communication) External optometry equipment/computer (through RS-232C cables)
Battery	:Nickel hydrogen battery (DR 10 made by Duracell) Operation time :About an hour for a full charge Charging time :About 1.5 hours.
Weight	:900 g (without battery) 1080 g (with battery)
Dimension (mm)	:163 (W) x 226 (H) x 233 (D)

Station

Fuse : Time-lag fuse	:125V-2A (for 100/120V area) 250V-1A (for 220/240V area)
Parts Number	(2A) DDB 30000 #4 RN754-05004 (1A) DDB 30000 #5 RN754-05005
Voltage Selector	:Automatic 100～240V
Weight	:1.25 kg
Dimension (mm)	:179 (W) x 105 (H) x 257 (D)

Printer

Paper width	:58 mm (same as NL-2)
Weight	:770 g (without batteries and with paper)
Dimension (mm)	: 93 (W) x 77 (H) x 266 (D)

Battery

Nominal voltage	: 6 VDC
Weight	: 180 g
Dimension (mm)	: 46 (W) x 18.2 (H) x 89.3 (D)

3 Inspection

3-1 Shipping Inspection (Quick Inspection)

Main body

1) Are there any scratches and contamination on the surface ?
   Are any rubber caps lost ?
2) Does the forehead rest operate smoothly ?
3) Does the view finder drop from the main body by its own weight ?
4) Is the power turned on by using the battery ?
5) Is the power turned on by using the external cable ?
6) Do the keyboard and LED indicators operate properly ?
7) Does the chart slant or have any dust ?
8) Does the R/L sensor identify a right or left eye properly ?
9) Does the eyepiece adjustment move smoothly ?
   Does the inside of eyepiece have any dust ?
10) Is there any problem with measurement data when measurement is taken using the model eyes mode.
11) Are all the DIP switches (in the grip) set to OFF ?
12) Do internal cables stick out from the main body ?
    (They must be pinched with the cover.)

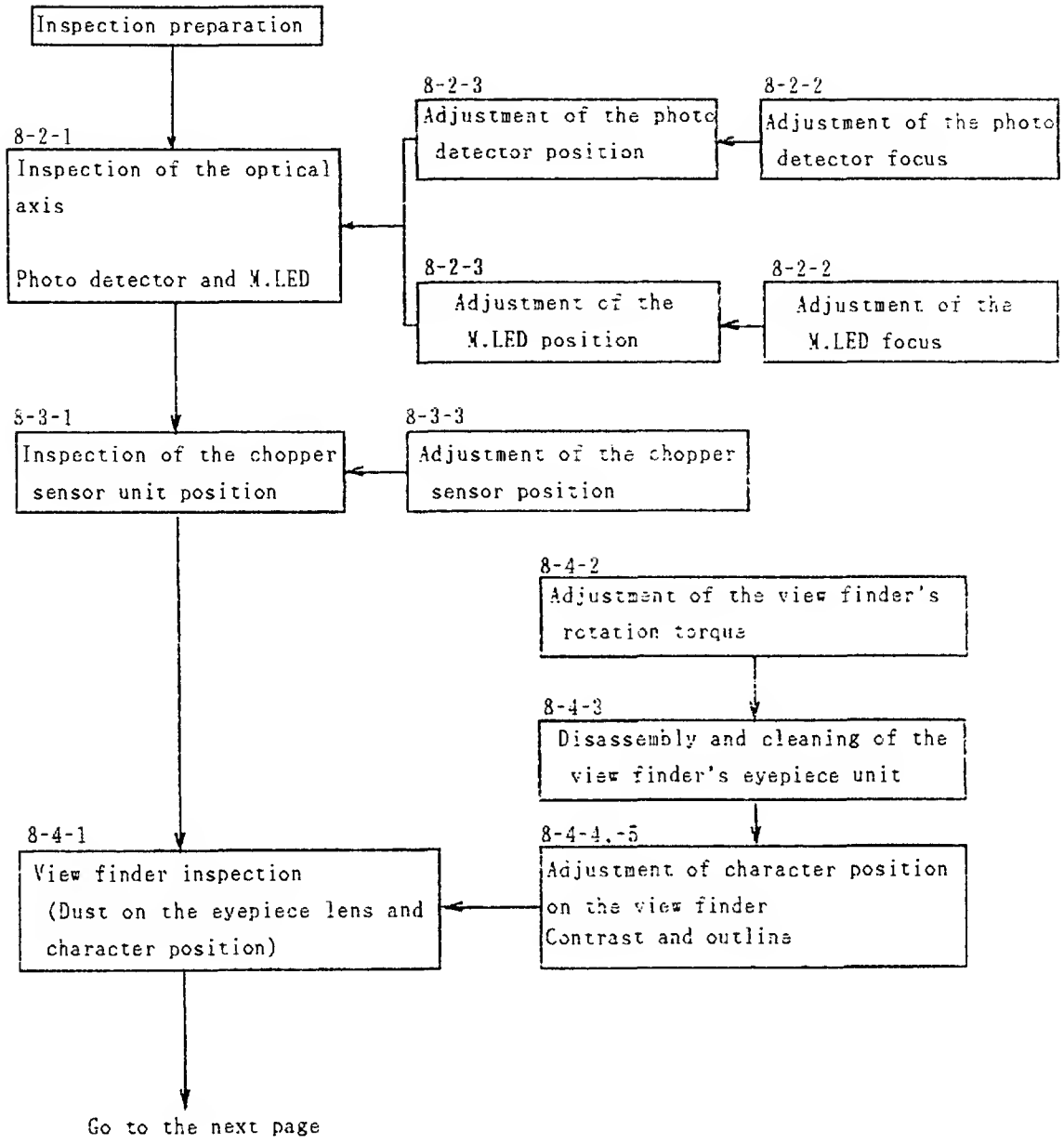
Station

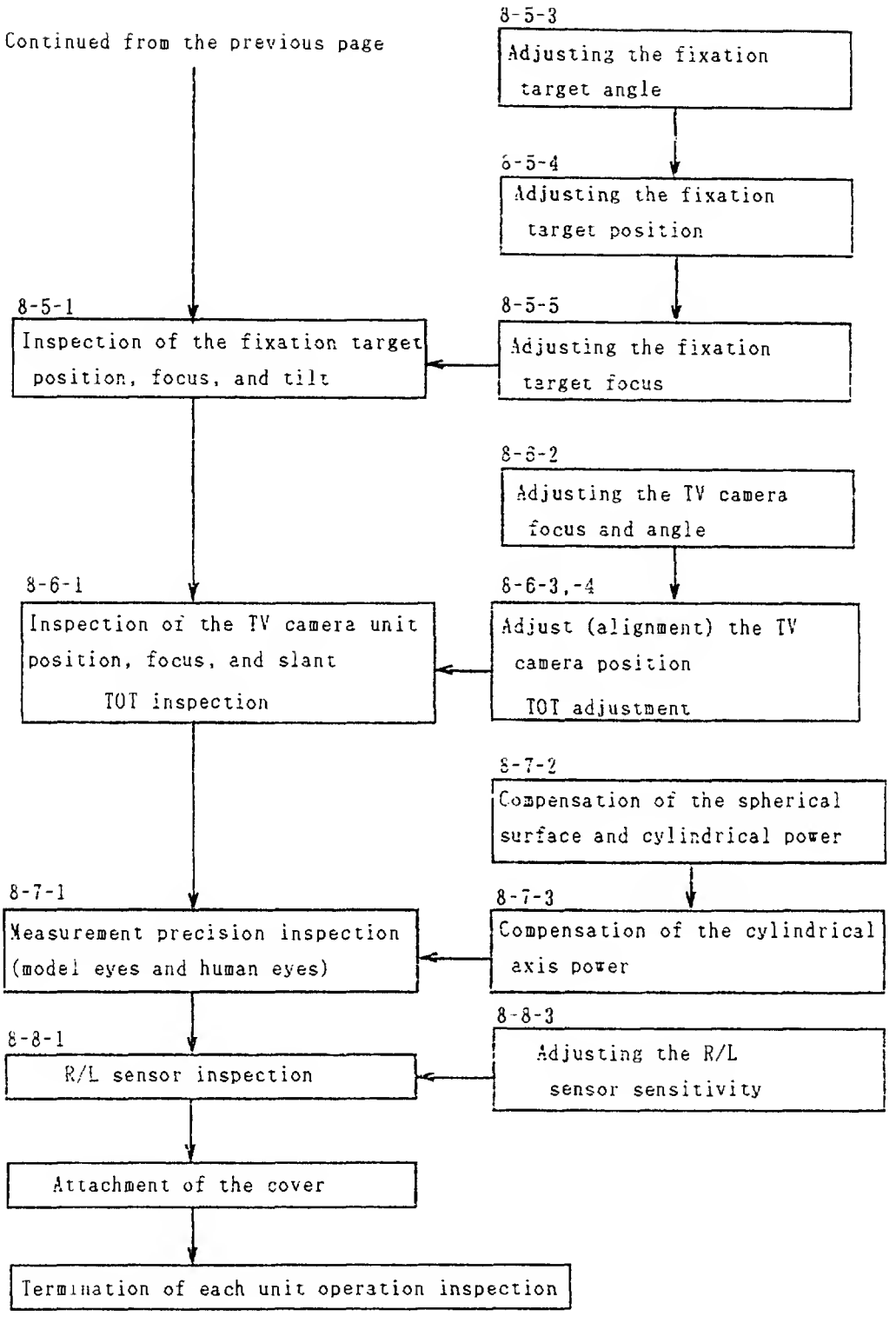
1) Are there any scratches and contamination on the surface ?
2) Does the power switch function properly when it is set to ON or OFF.
3) Do the keyboard and LED indicators operate properly ?

Printer

1) Are there any scratches and contamination on the surface ?
2) Does the power switch function properly when it is set to ON or OFF.
3) Can it be installed on the station easily ? Are the connectors connected properly ?
4) Is measurement data printed properly ?
5) Are the DIP switches set to the specified positions ?

3 - 2 Inspection and Adjustment Procedure Flowchart




Continued from the previous page
8-5-3
Adjusting the fixation target angle
8-5-4
Adjusting the fixation target position
8-5-1
Inspection of the fixation target position, focus, and tilt
8-5-5
Adjusting the fixation target focus
8-6-2
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8-6-1
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8-7-2
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8-7-1
Measurement precision inspection (model eyes and human eyes)
8-7-3
Compensation of the cylindrical axis power
8-8-3
Adjusting the R/L sensor sensitivity
8-8-1
R/L sensor inspection
Attachment of the cover
Termination of each unit operation inspection

3－3 Inspection Reference List

limit of tolerances

Main body

View finder

Upper direction (Rotate it in 30 degrees or more)
Lower direction (Rotate it in 30 degrees or more)
The view finder must not drop by its own weight.

Automatic fogging system

TEST-0A	0DP	±0.5D
	+10DP	±0.5D
	-10DP	±0.5D

Alignment system

When the LED is focused in the center of the finder
X: ±65 or less, Y: ±35 or less
TOT reference: 190 ±30

Measurement precision

Spherical surface reference

+22D to +18D	±0.75
+16D to +12D	±0.5
+10D to -10D	±0.25
-12D to -16D	±0.5
-18D	±0.75

Cylindrical power reference

+22D to +18D	±0.75
+16D to +12D	±0.5
+10D to -10D	±0.25
-12D to -16D	±0.5
-18D	±0.75

Cylindrical axis power
±5° or less

Small pupil measurement φ2.7 mm

Power saving function The power saving function must operate if no data is entered for about 3 minutes.

4 Trouble-shooting

4-1 Trouble-shooting

4-1-1 Trouble-shooting for the main body

① The main body power is not turned on. The view finder does not display any information.....8
② The Accuracy of measurement is bad.....9
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④ The life of the battery is too short.....12
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③ The power lamp flickers.....17
④ The printer buzzer beeps.....18
⑤ Nothing is printed (blank paper is output.).....19
⑥ Data is not printed even when you press the PRINT key.....20
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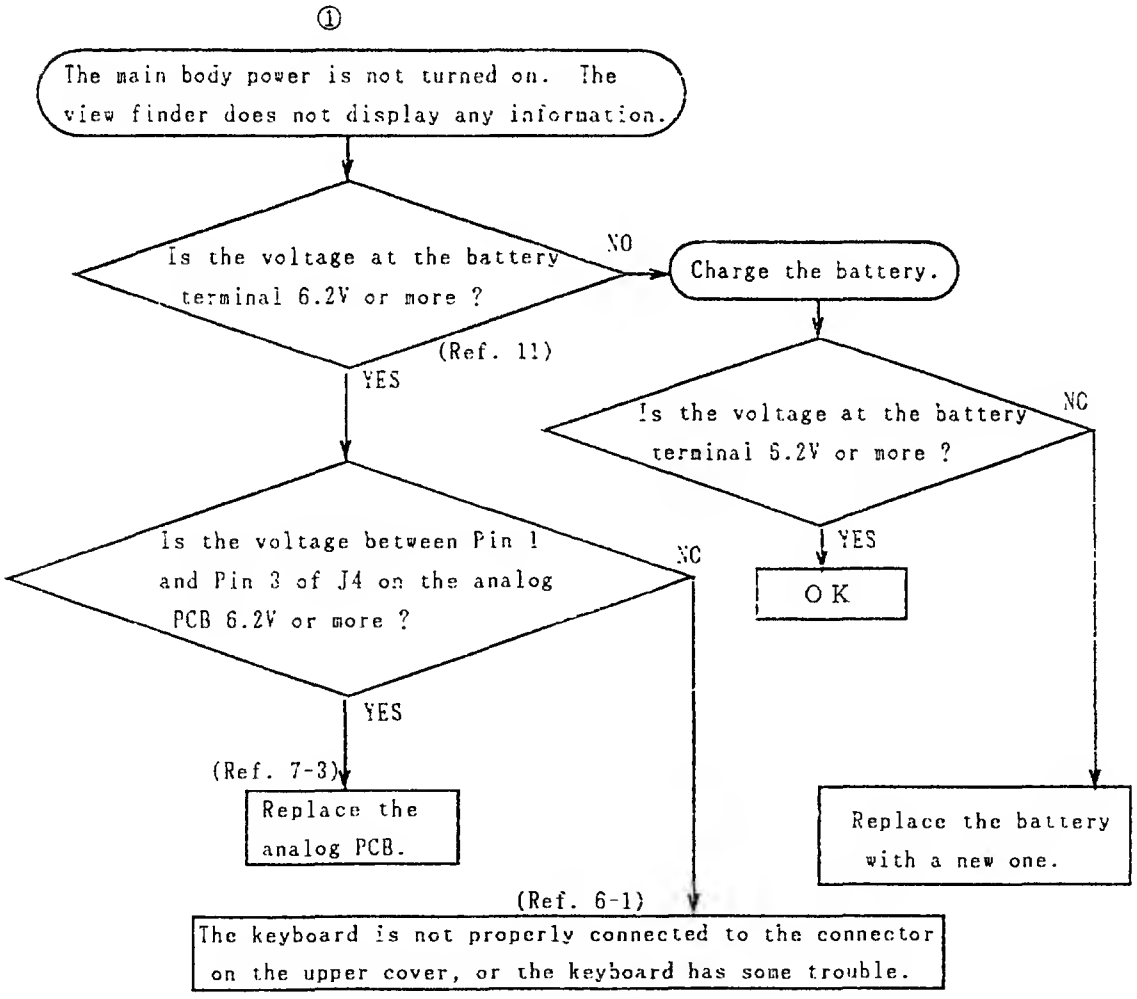
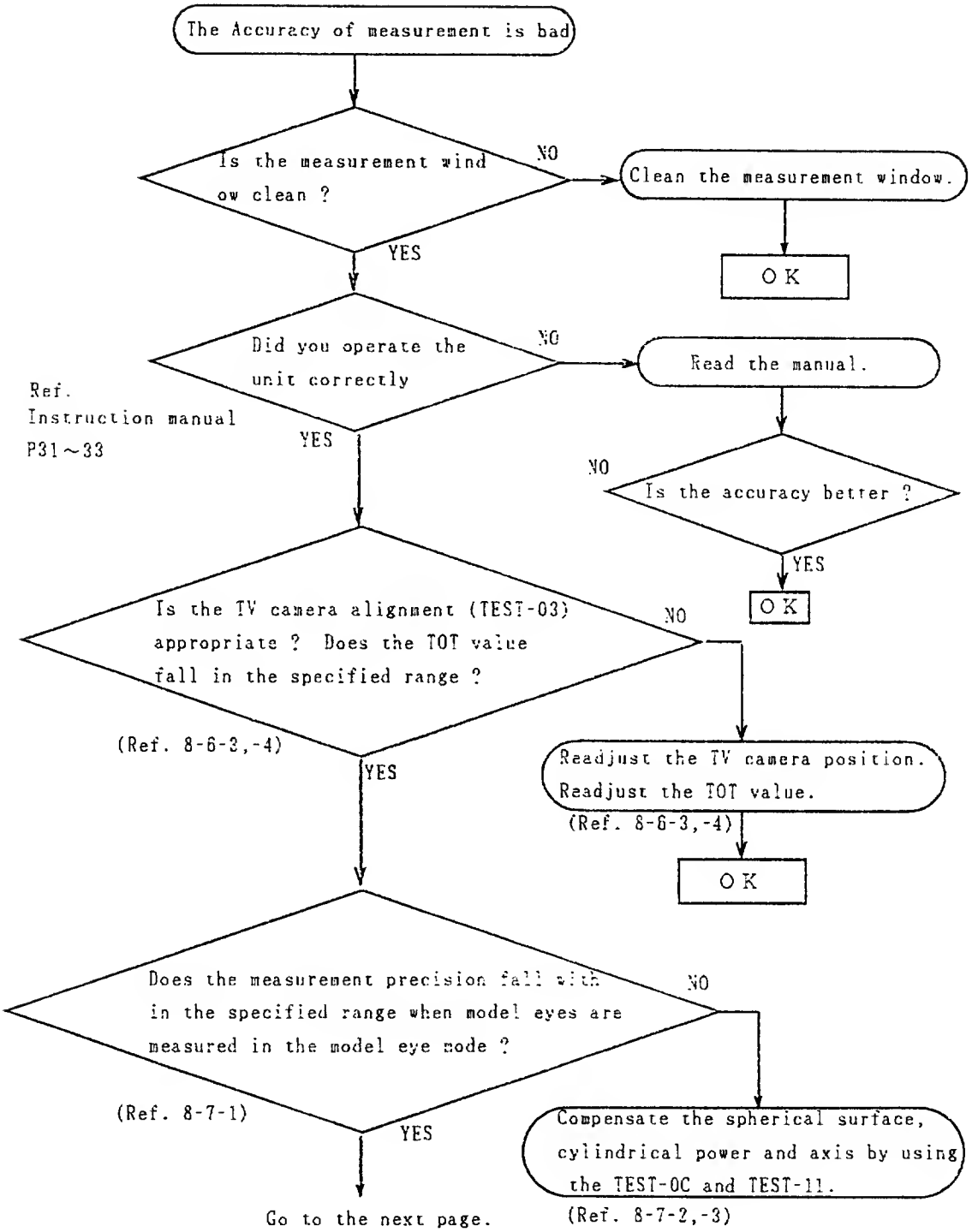
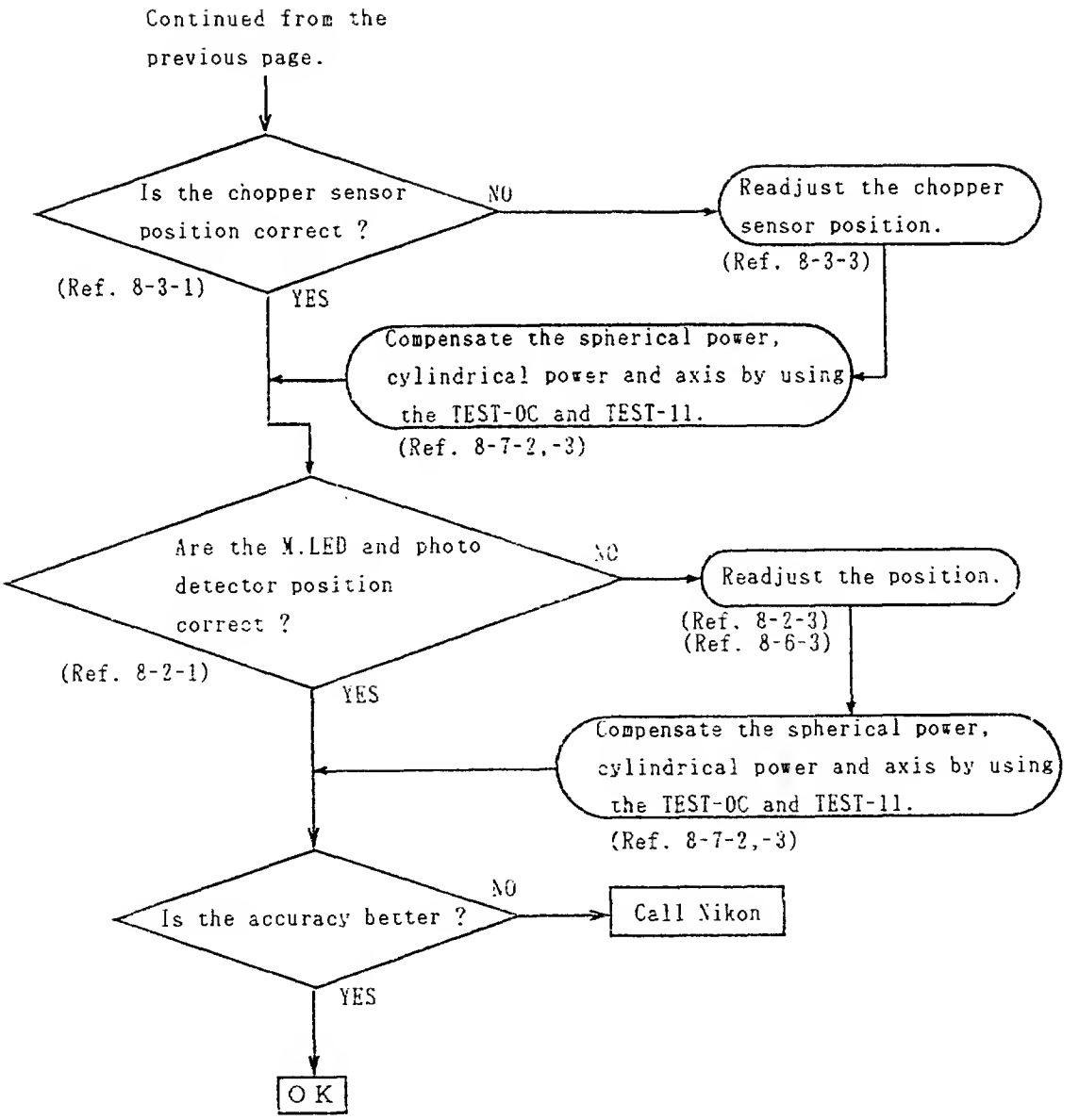
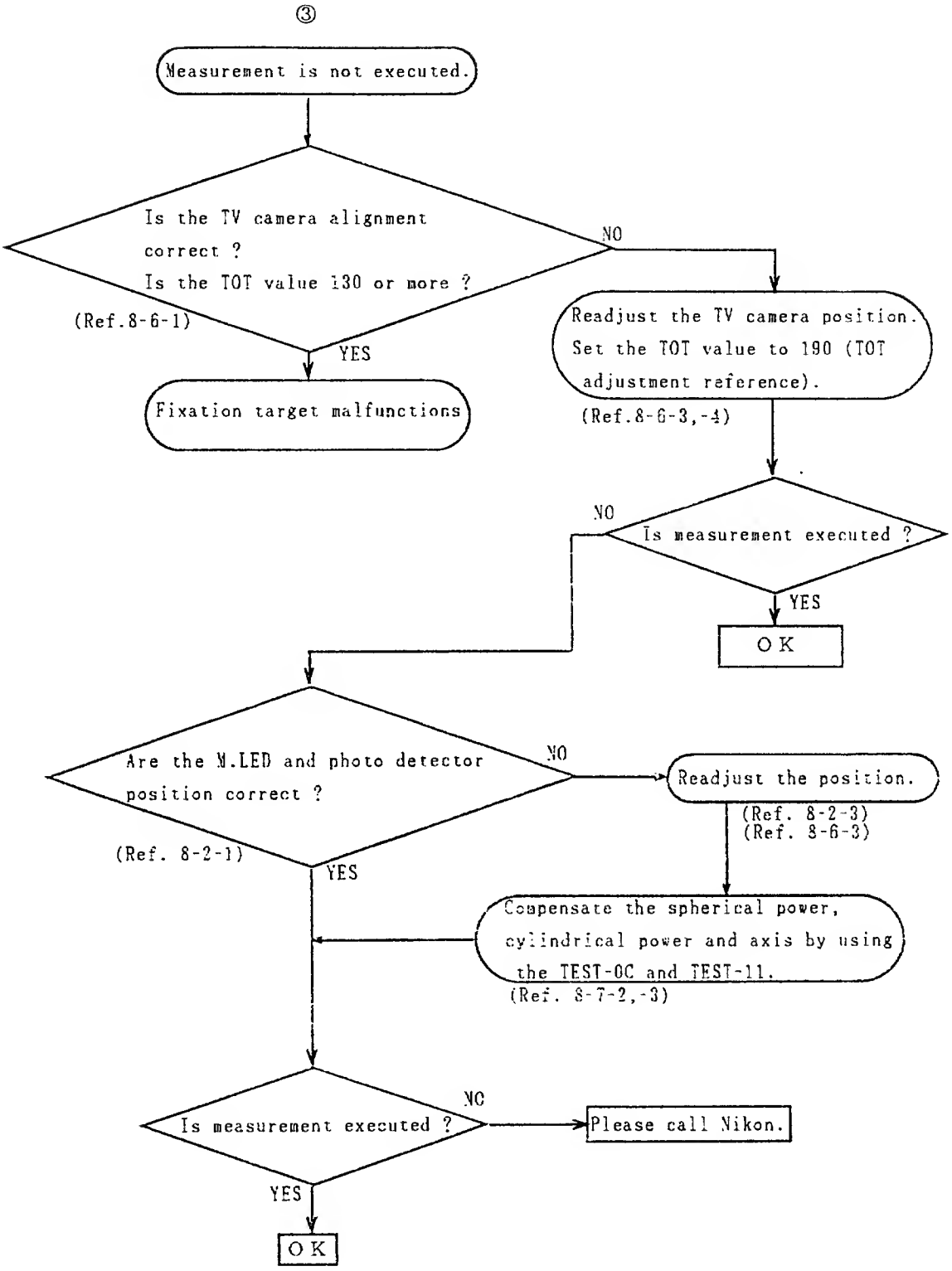

①
The main body power is not turned on. The view finder does not display any information.
Is the voltage at the battery terminal 6.2V or more ?
NO
Charge the battery.
(Ref. 11)
YES
Is the voltage at the battery terminal 6.2V or more ?
NO
YES
OK
Is the voltage between Pin 1 and Pin 3 of J4 on the analog PCB 6.2V or more ?
NO
YES
(Ref. 7-3)
Replace the analog PCB.
Replace the battery with a new one.
(Ref. 6-1)
The keyboard is not properly connected to the connector on the upper cover, or the keyboard has some trouble.

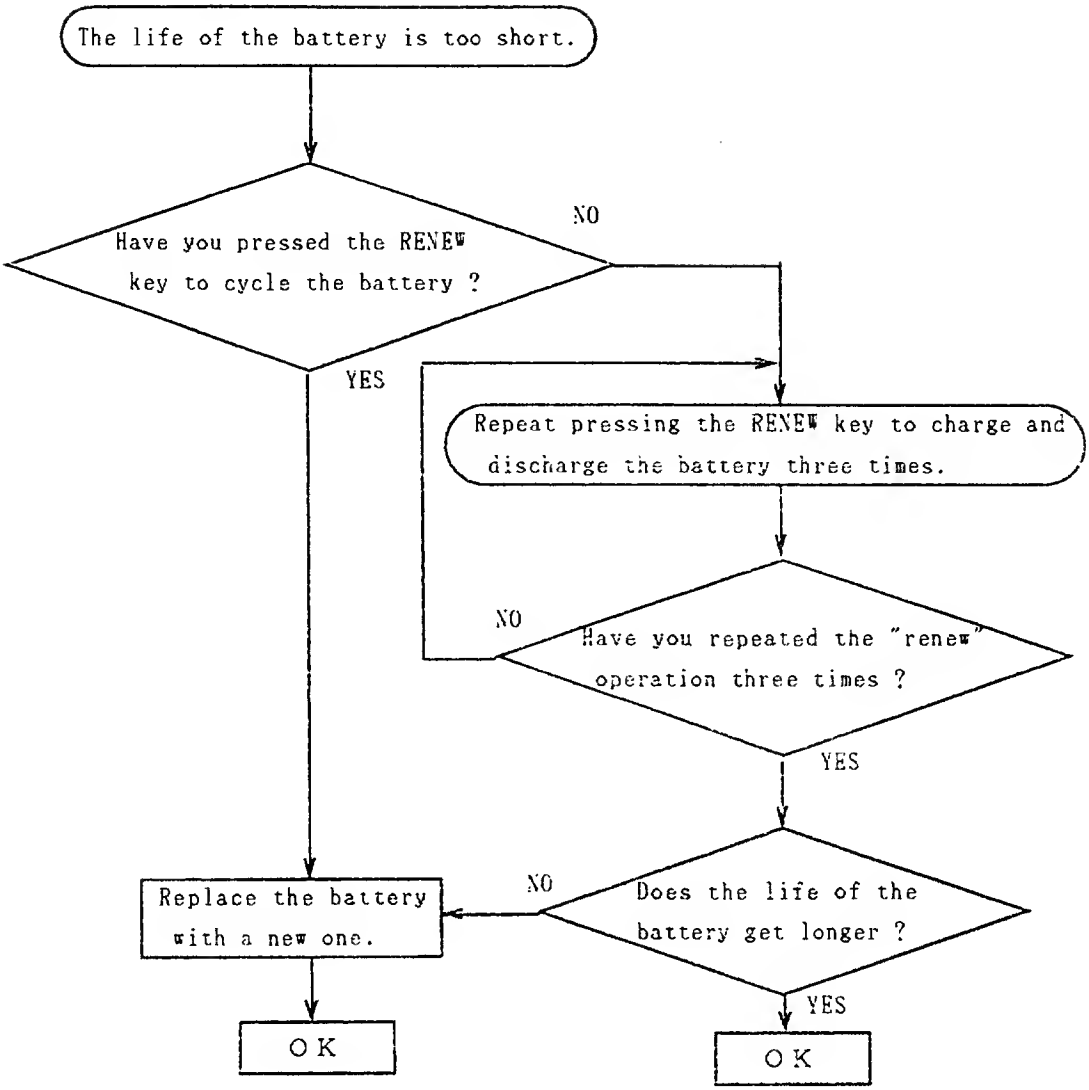
②


The Accuracy of measurement is bad
Is the measurement window clean ?
NO
Clean the measurement window.
OK
YES
Did you operate the unit correctly
NO
Read the manual.
Ref.
Instruction manual
P31～33
YES
NO
Is the accuracy better ?
YES
OK
Is the TV camera alignment (TEST-03) appropriate ? Does the TOT value fall in the specified range ?
NO
(Ref. 8-6-3,-4)
YES
Readjust the TV camera position.
Readjust the TOT value.
(Ref. 8-6-3,-4)
OK
Does the measurement precision fall with in the specified range when model eyes are measured in the model eye mode ?
NO
(Ref. 8-7-1)
YES
Compensate the spherical surface, cylindrical power and axis by using the TEST-0C and TEST-11.
(Ref. 8-7-2,-3)
Go to the next page.

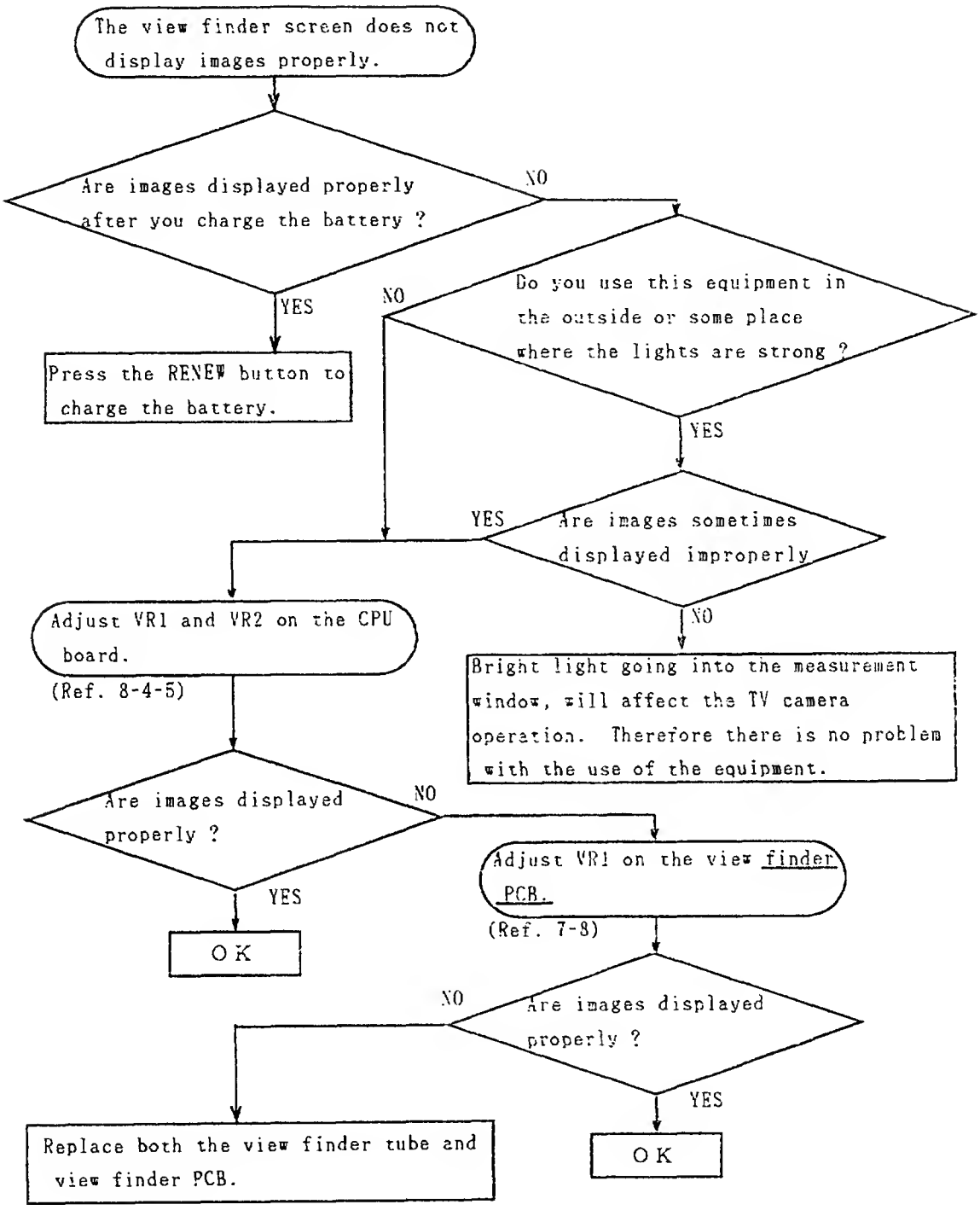

Continued from the previous page.
Is the chopper sensor position correct ?
NO
Readjust the chopper sensor position.
(Ref. 8-3-3)
(Ref. 8-3-1)
YES
Compensate the spherical power, cylindrical power and axis by using the TEST-0C and TEST-11.
(Ref. 8-7-2,-3)
Are the M.LED and photo detector position correct ?
NO
Readjust the position.
(Ref. 8-2-3)
(Ref. 8-6-3)
(Ref. 8-2-1)
YES
Compensate the spherical power, cylindrical power and axis by using the TEST-0C and TEST-11.
(Ref. 8-7-2,-3)
Is the accuracy better ?
NO
Call Nikon
YES
OK


③
Measurement is not executed.
Is the TV camera alignment correct ?
Is the TOT value 130 or more ?
(Ref.8-6-1)
NO
YES
Fixation target malfunctions
Readjust the TV camera position.
Set the TOT value to 190 (TOT adjustment reference).
(Ref.8-6-3,-4)
NO
Is measurement executed ?
YES
OK
Are the M.LED and photo detector position correct ?
(Ref. 8-2-1)
NO
YES
Readjust the position.
(Ref. 8-2-3)
(Ref. 8-6-3)
Compensate the spherical power, cylindrical power and axis by using the TEST-0C and TEST-11.
(Ref. 8-7-2,-3)
Is measurement executed ?
NO
YES
Please call Nikon.
OK

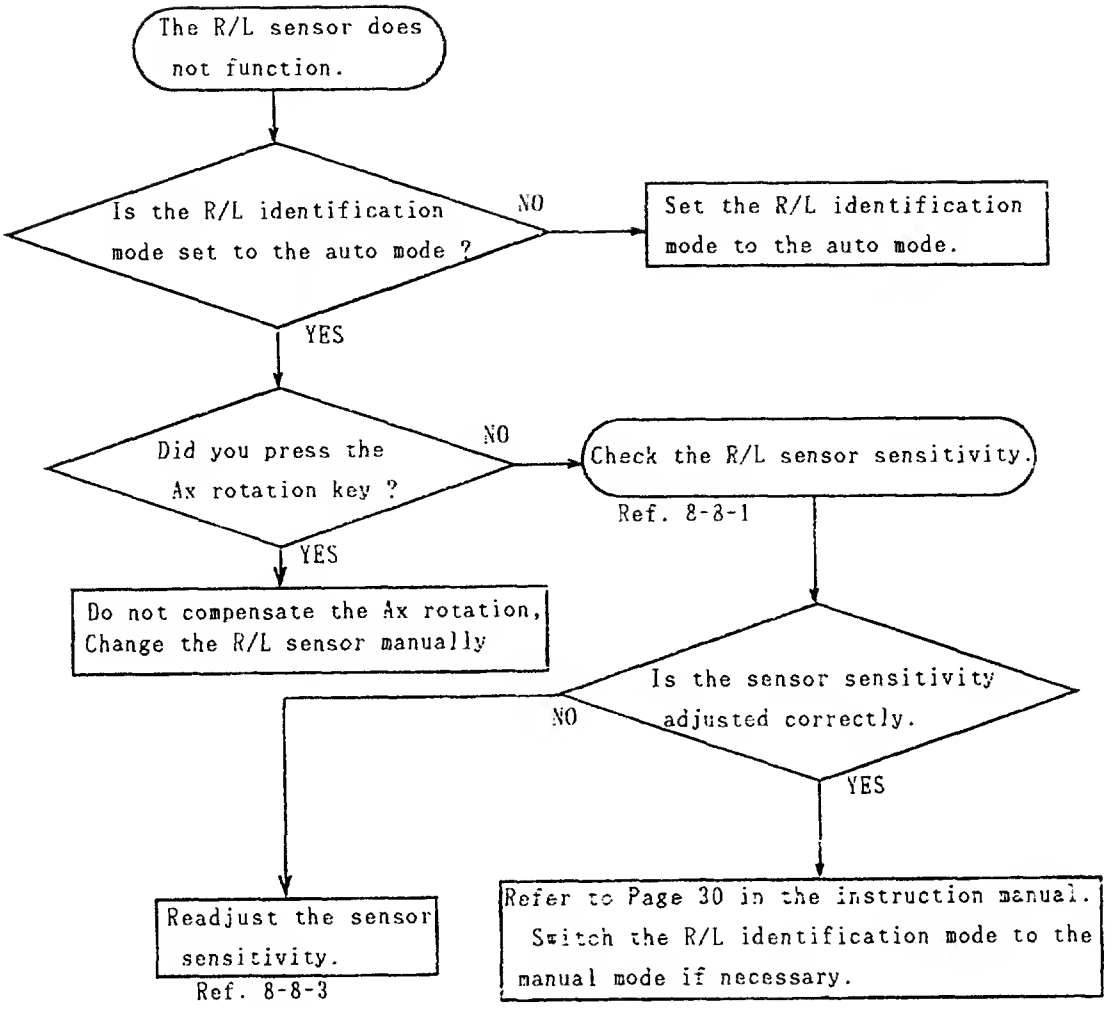
④


The life of the battery is too short.
Have you pressed the RENEW key to cycle the battery ?
NO
YES
Repeat pressing the RENEW key to charge and discharge the battery three times.
Have you repeated the "renew" operation three times ?
NO
YES
Does the life of the battery get longer ?
NO
YES
Replace the battery with a new one.
OK
OK

⑤

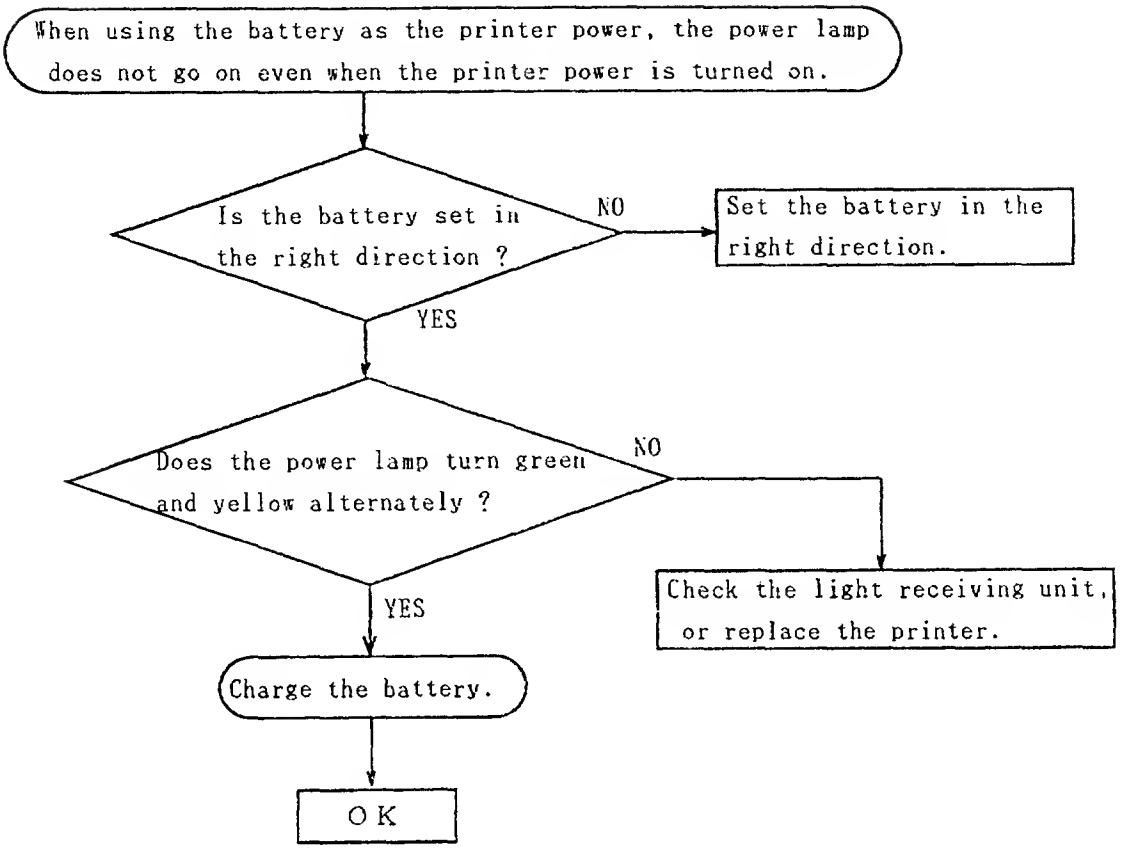

The view finder screen does not display images properly.
Are images displayed properly after you charge the battery ?
NO
YES
Press the RENEW button to charge the battery.
Do you use this equipment in the outside or some place where the lights are strong ?
NO
YES
Are images sometimes displayed improperly
YES
NO
Adjust VR1 and VR2 on the CPU board.
(Ref. 8-4-5)
Bright light going into the measurement window, will affect the TV camera operation. Therefore there is no problem with the use of the equipment.
Are images displayed properly ?
NO
YES
OK
Adjust VR1 on the view finder PCB.
(Ref. 7-8)
Are images displayed properly ?
NO
YES
Replace both the view finder tube and view finder PCB.
OK

⑥

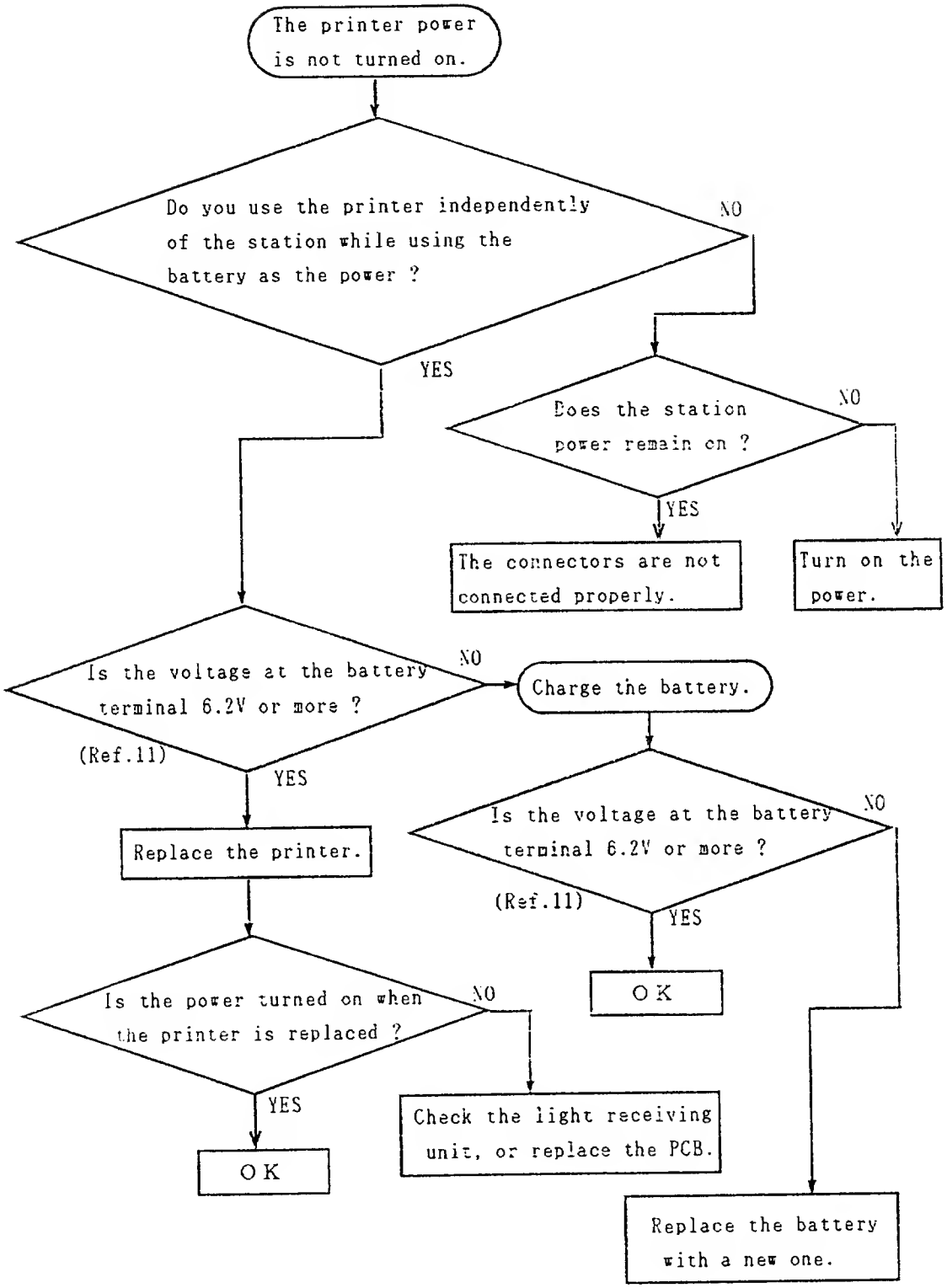

The R/L sensor does not function.
Is the R/L identification mode set to the auto mode ?
NO
Set the R/L identification mode to the auto mode.
YES
Did you press the Ax rotation key ?
NO
Check the R/L sensor sensitivity.
Ref. 8-8-1
YES
Do not compensate the Ax rotation, Change the R/L sensor manually
Is the sensor sensitivity adjusted correctly.
NO
YES
Readjust the sensor sensitivity.
Ref. 8-8-3
Refer to Page 30 in the instruction manual. Switch the R/L identification mode to the manual mode if necessary.

Trouble-shooting for the Printer

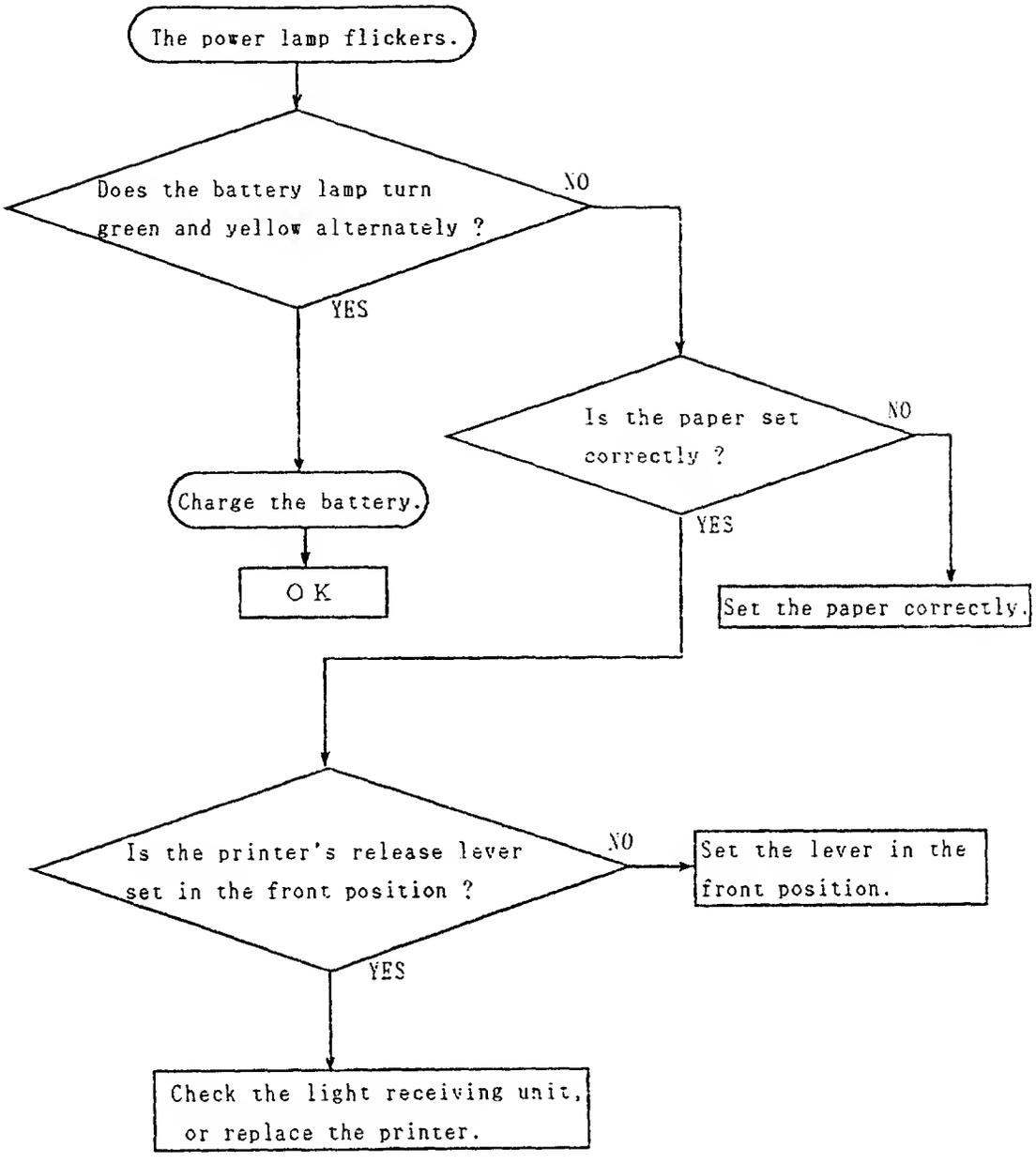
①

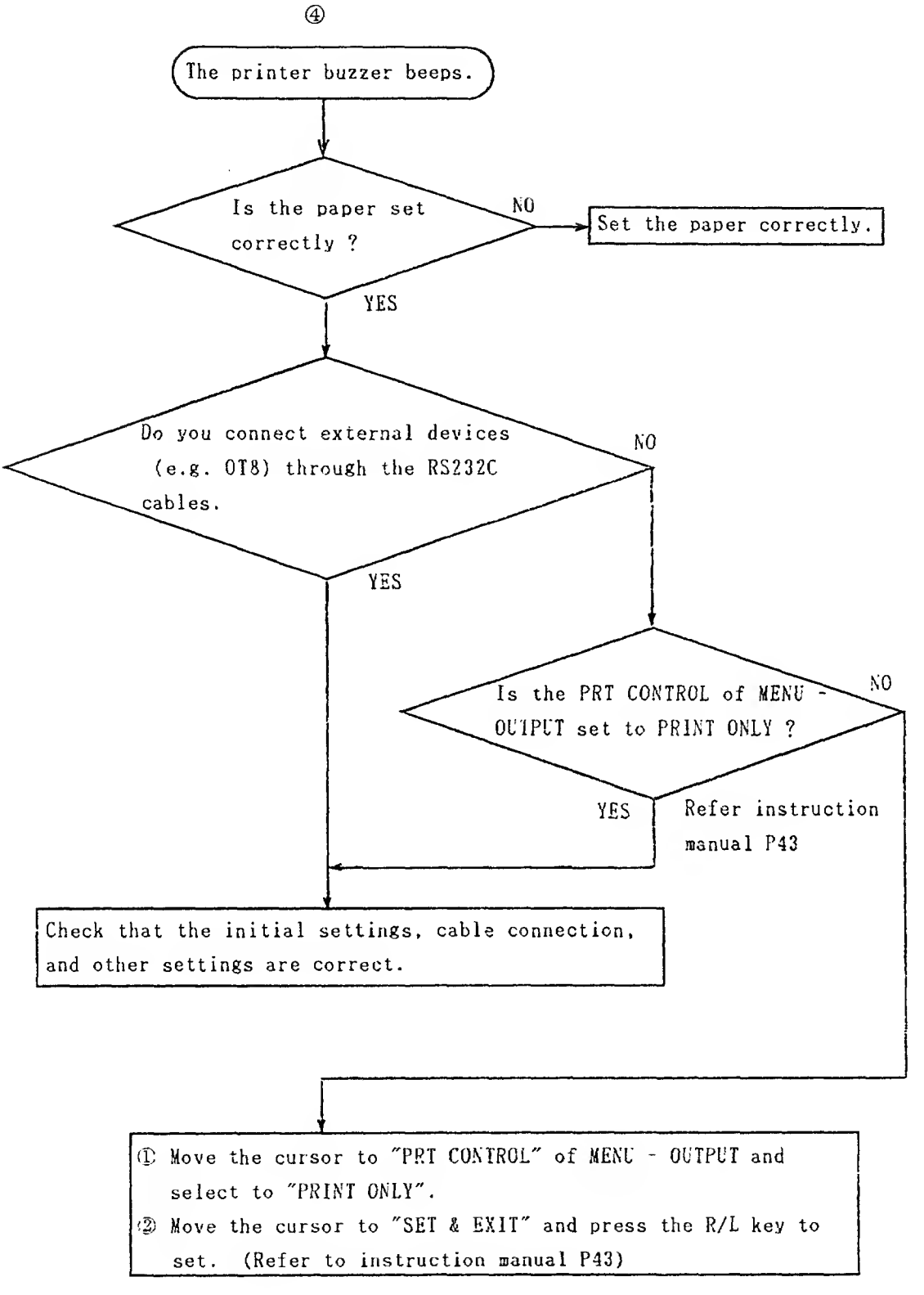

When using the battery as the printer power, the power lamp does not go on even when the printer power is turned on.
Is the battery set in the right direction ?
NO
Set the battery in the right direction.
YES
Does the power lamp turn green and yellow alternately ?
NO
Check the light receiving unit, or replace the printer.
YES
Charge the battery.
OK

②

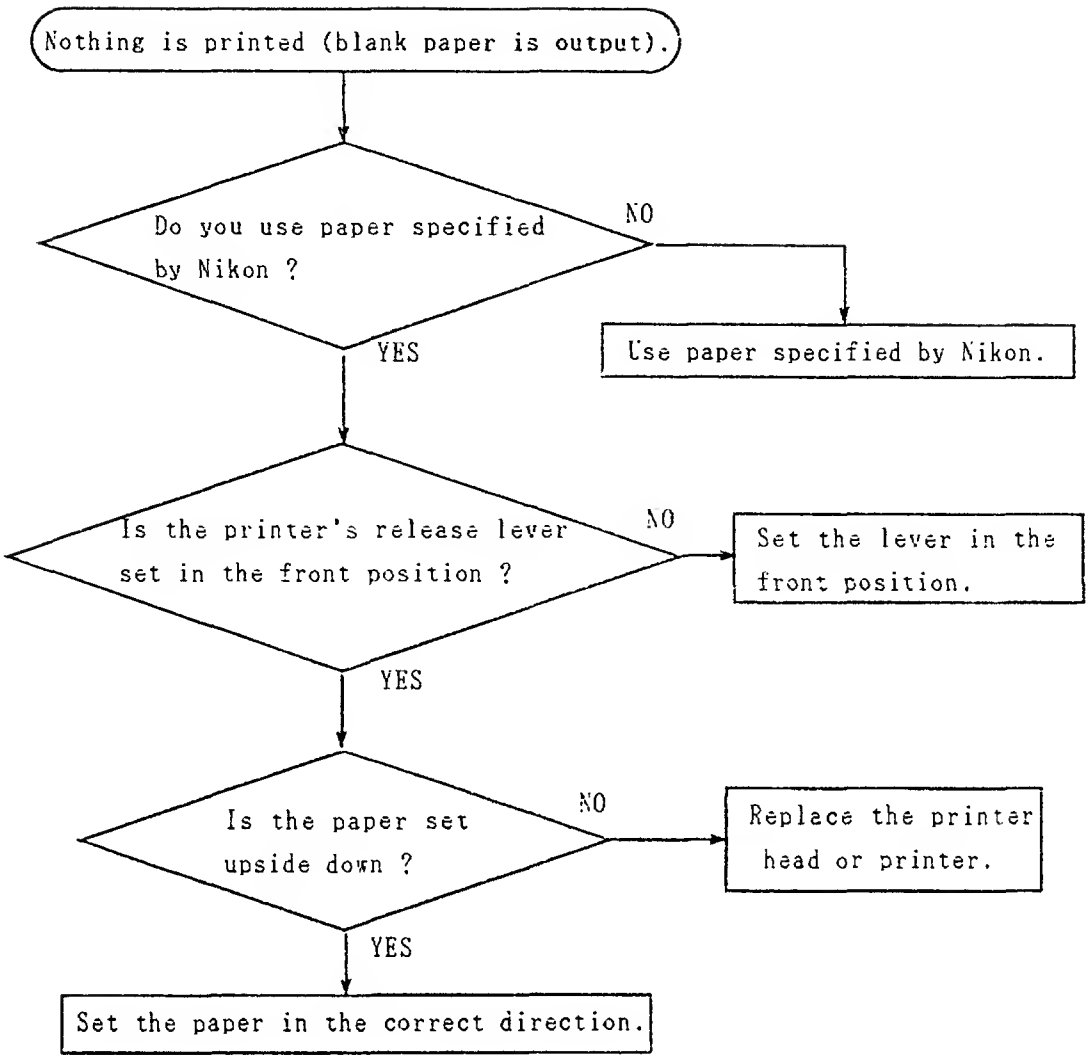

The printer power is not turned on.
Do you use the printer independently of the station while using the battery as the power ?
NO
YES
Does the station power remain on ?
NO
YES
The connectors are not connected properly.
Turn on the power.
Is the voltage at the battery terminal 6.2V or more ?
NO
(Ref.11)
YES
Charge the battery.
Replace the printer.
Is the voltage at the battery terminal 6.2V or more ?
NO
(Ref.11)
YES
OK
Is the power turned on when the printer is replaced ?
NO
YES
OK
Check the light receiving unit, or replace the PCB.
Replace the battery with a new one.

③

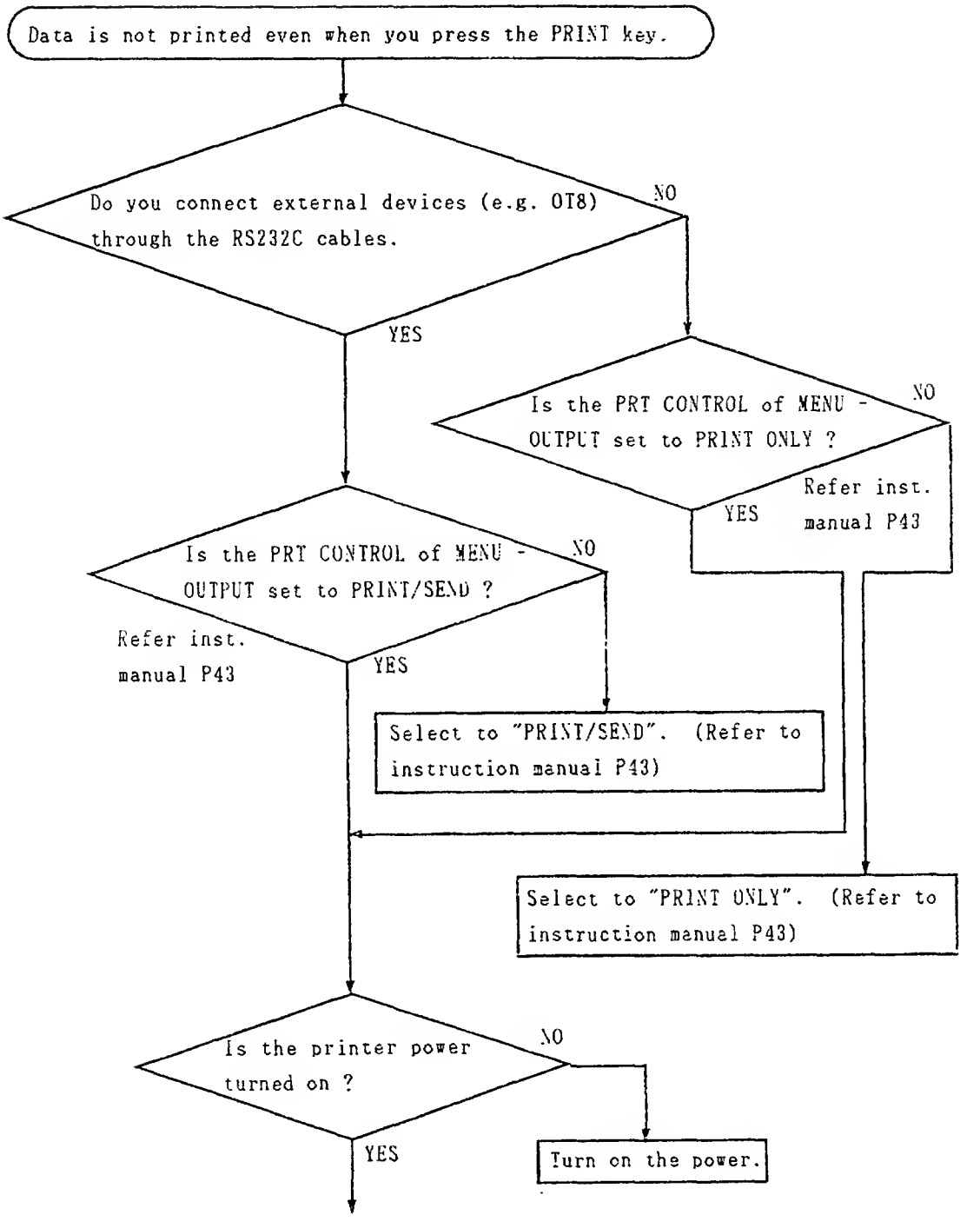

The power lamp flickers.
Does the battery lamp turn green and yellow alternately ?
NO
YES
Charge the battery.
OK
Is the paper set correctly ?
NO
YES
Set the paper correctly.
Is the printer's release lever set in the front position ?
NO
Set the lever in the front position.
YES
Check the light receiving unit, or replace the printer.


④
The printer buzzer beeps.
Is the paper set correctly ?
NO
Set the paper correctly.
YES
Do you connect external devices (e.g. OT8) through the RS232C cables.
NO
YES
Is the PRT CONTROL of MENU - OUTPUT set to PRINT ONLY ?
NO
YES
Refer instruction manual P43
Check that the initial settings, cable connection, and other settings are correct.
① Move the cursor to "PRT CONTROL" of MENU - OUTPUT and select to "PRINT ONLY".
② Move the cursor to "SET & EXIT" and press the R/L key to set. (Refer to instruction manual P43)

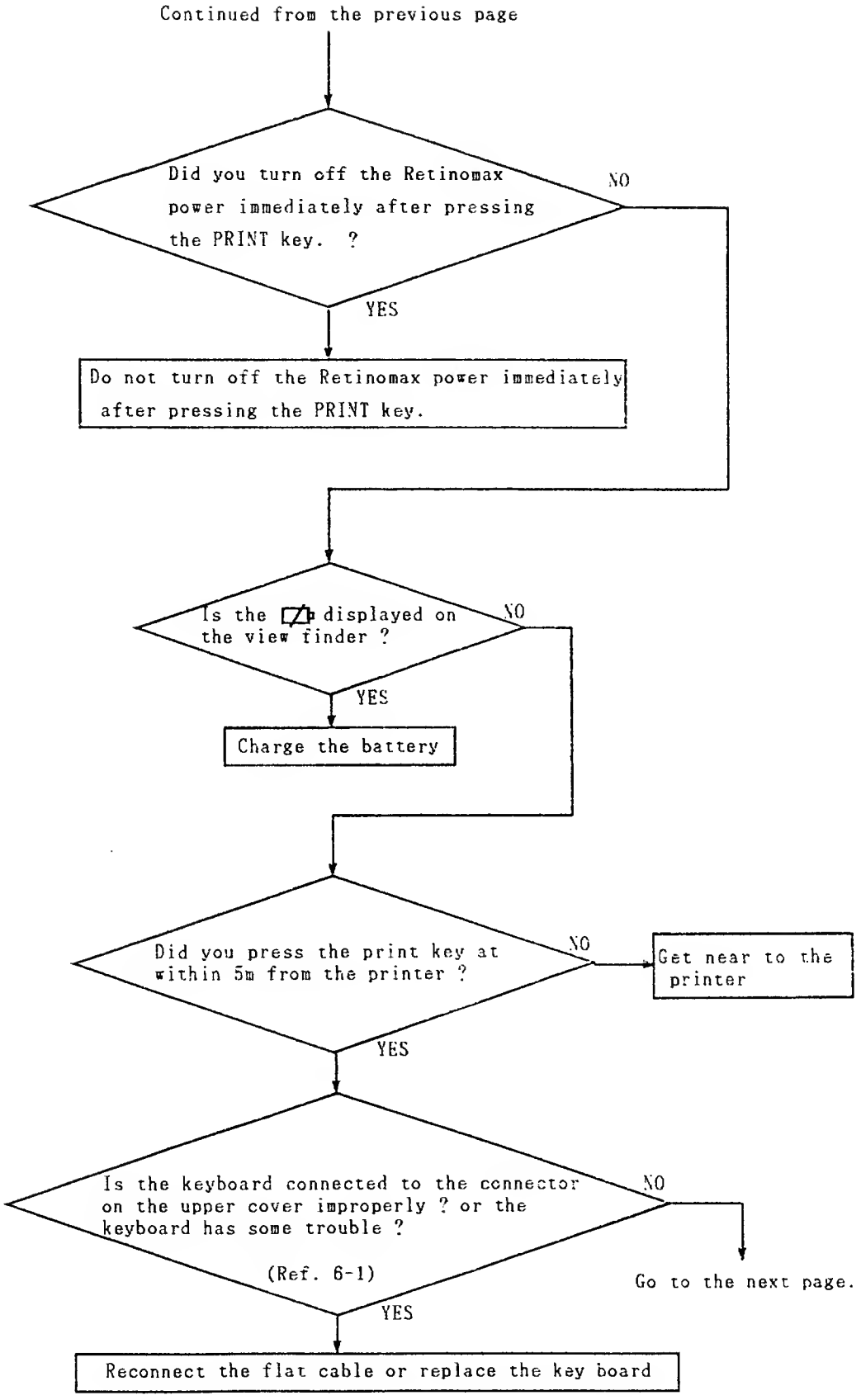
⑤


Nothing is printed (blank paper is output).
Do you use paper specified by Nikon ?
NO
Use paper specified by Nikon.
YES
Is the printer's release lever set in the front position ?
NO
Set the lever in the front position.
YES
Is the paper set upside down ?
NO
Replace the printer head or printer.
YES
Set the paper in the correct direction.

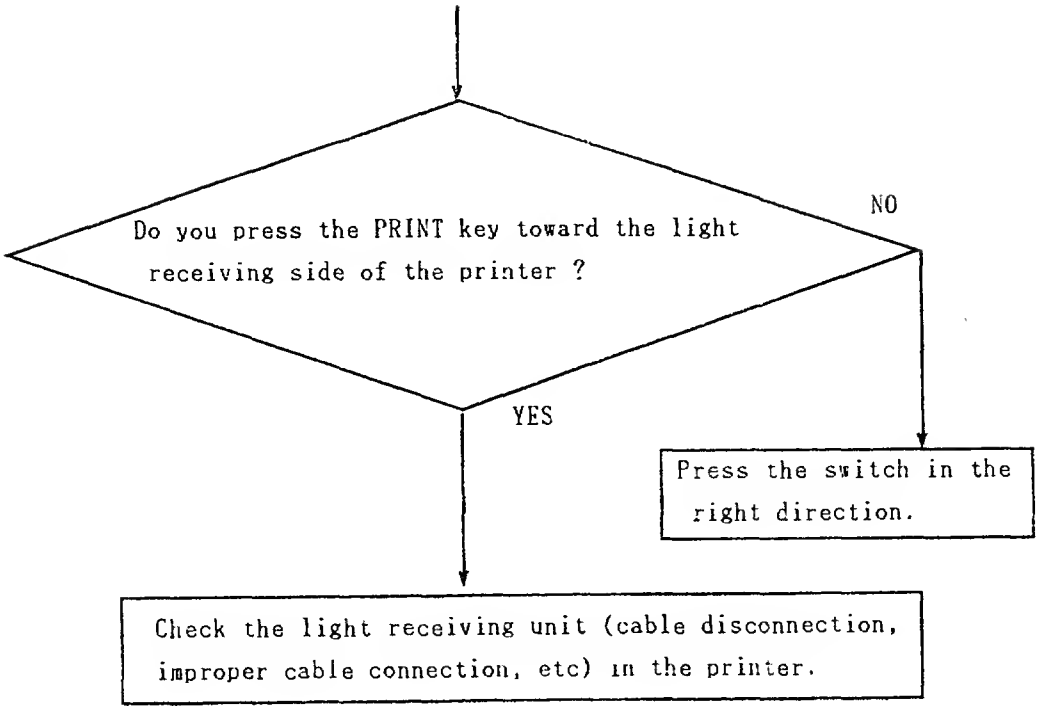
⑥


Data is not printed even when you press the PRINT key.
Do you connect external devices (e.g. OT8) through the RS232C cables.
NO
YES
Is the PRT CONTROL of MENU - OUTPUT set to PRINT ONLY ?
NO
YES
Refer inst. manual P43
Is the PRT CONTROL of MENU - OUTPUT set to PRINT/SEND ?
NO
YES
Refer inst. manual P43
Select to "PRINT/SEND". (Refer to instruction manual P43)
Select to "PRINT ONLY". (Refer to instruction manual P43)
Is the printer power turned on ?
NO
YES
Turn on the power.
Go to the next page.

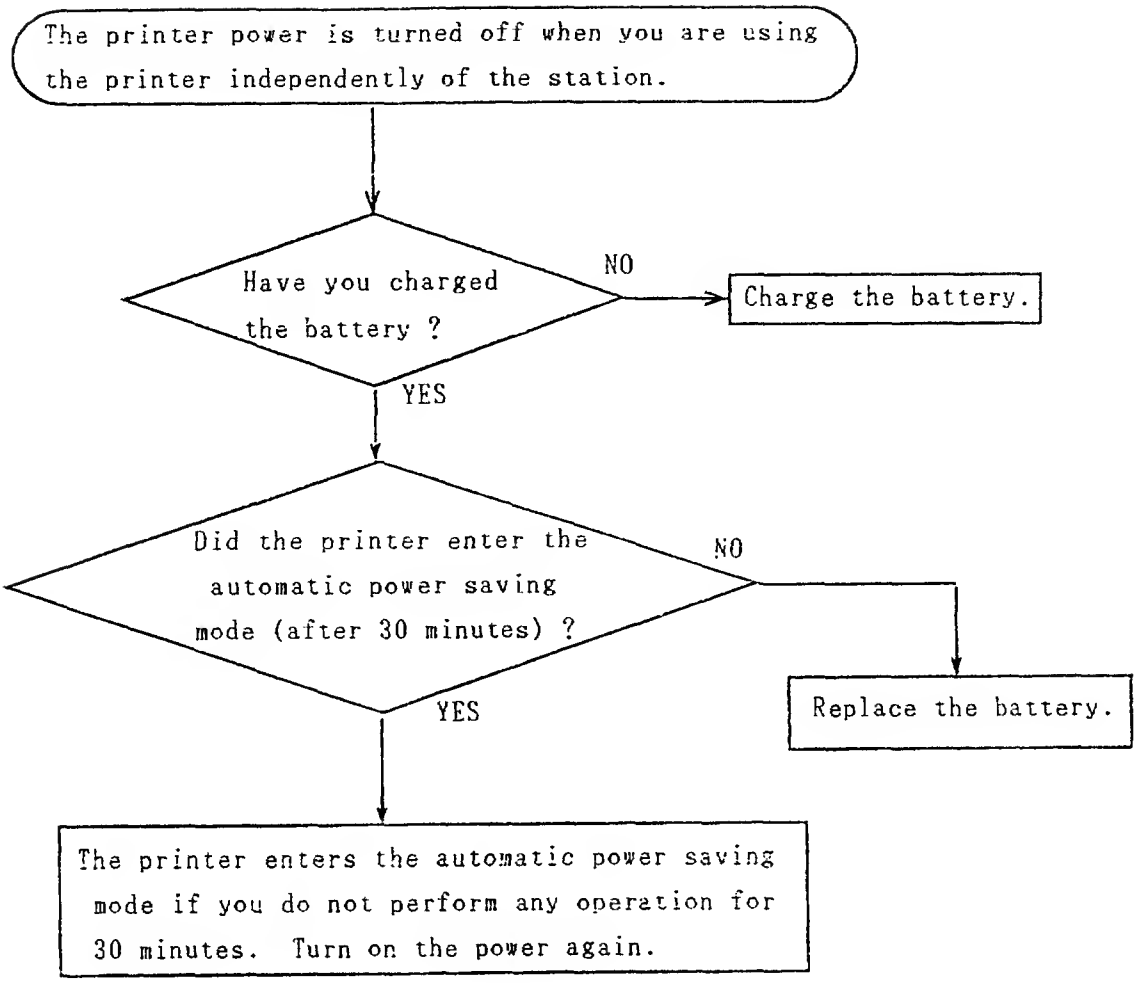
Continued from the previous page


Did you turn off the Retinomax power immediately after pressing the PRINT key. ?
NO
YES
Do not turn off the Retinomax power immediately after pressing the PRINT key.
Is the displayed on the view finder ?
NO
YES
Charge the battery
Did you press the print key at within 5m from the printer ?
NO
Get near to the printer
YES
Is the keyboard connected to the connector on the upper cover improperly ? or the keyboard has some trouble ?
(Ref. 6-1)
NO
Go to the next page.
YES
Reconnect the flat cable or replace the key board

Continued from the previous page

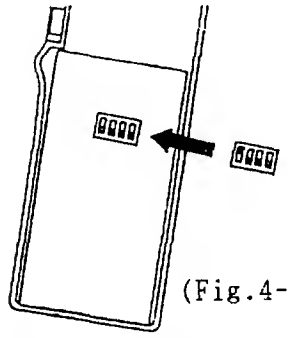

Do you press the PRINT key toward the light receiving side of the printer ?
NO
YES
Press the switch in the right direction.
Check the light receiving unit (cable disconnection, improper cable connection, etc) in the printer.

⑦


The printer power is turned off when you are using the printer independently of the station.
Have you charged the battery ?
NO
Charge the battery.
YES
Did the printer enter the automatic power saving mode (after 30 minutes) ?
NO
Replace the battery.
YES
The printer enters the automatic power saving mode if you do not perform any operation for 30 minutes. Turn on the power again.

4－2　Error Messages

① TURN OFF NO1 SWITCH



(Fig.4-1)

Cause: You turn on the power with the left-end DIP switch (in the grip) set to the upper position.

Countermeasure: Set the left-end DIP switch to the lower position and turn on the power.

(Refer to Fig. 4-1)

② FOG ERROR

Cause: When you turn on the power, the fog sensor light is not shaded by the sensor plate in the specified time. The unit do not initialize the fixation target properly.

Possible cause 1: Connectors of the fixation target sensor or fixation target motor are disconnected. The cable soldering is erroneous.

Possible cause 2: The mechanical part of the fixation target malfunctions and the fixation target does not move.

Possible cause 3: The fixation target sensor or fixation target motor is faulty.

Possible cause 4: The fixation target lamp cables or other parts disturbs the fixation target movement.

③ C OVER

Cause: The measured eye has cylindrical power which exceeds the measurement range.

Countermeasure: The problem is not in the equipment but in the fact that the cylindrical power exceeds the measurement range.

5 Test Program

5-1 Start Procedure and Basic Operation of the Test Program

(1) Procedure of Starting the Test Program

① Set to on DIP switch No.1 in the grip.

② While pressing the measurement start button on the grip, turn on the Retinomax power.

③ After the equipment is started, the following test program menu is displayed on the view finder.

```
  TEST-MNU  VER 1.10
> EXIT              0A:FOG  OFST
  00:SNS/SW         0B:
  01:R/L  SNS       0C:INPUT  DT
  02:SPH  SHFT      0D:
  03:ALIGN          0E:
  04:               0F:INIT  EEP
  05:               10:
  06:               11:AX  OFST
  07:SHUTDOWN       12:PRINT
  08:TVDC  CHK      13:M-MODE
  09:CRT  POS       14:D-SETUP
```

(FIG. 5-1)

(2) Basic operation

① Description: You can operate the switches on the Retinomax's measurement unit to select and run test programs. The operation keys are described below.

② Operation keys list

· · · Called the AXIS ROTATION key and moves the cursor (>) downward to select a test item.

· · · Called the QUICK key and moves the cursor (>) upward to select a test item.

· · · Called the R/L key and executes each test.

③ Select a test program

Use the AXIS ROTATION key and QUICK key to move the cursor (>) to a test item to execute.

④ Execute a test program

Press the R/L key to execute a test program selected with the cursor. The screen displays the mode corresponding to the selected program. (In the following description, the phrase "execute at ***** position" means to "move the cursor to ***** position and press the R/L key.)

⑤ Exit a test program

Move the cursor to "EXIT" and press the R/L key to exit a test program.

⑥ Return to the normal measurement mode
Move the cursor to "EXIT" on the menu screen and press the R/L key.
When trouble-shooting has been completed, set DIP switch No.1 to OFF.

Note that the message "TURN OFF NO1 SWITCH" is displayed when you turn on the power again with DIP switch No.1 set to ON.

5 – 2 Test Program List

00:SNS/SW	Checks the FOG sensor and switch settings and displays each voltage data.
01:R/L SNS	Adjusts the R/L sensor.
02:SPH SHFT	Parallel shifting of the spherical power
03:ALIGN	Checks and adjusts unit alignments.
04:	Not used.
05:	Not used.
06:	Not used.
07:SHUTDOWN	Checks the automatic power saving function.
08:TVDC	Checks the TVDC.
09:CRT POS	Adjusts the character positions and saving the offset value.
0A:FOG OFST	Adjusts the fogging offset values.
0B:	Not used.
0C:INPUT DT	Adjusts the sph. and cyl. powers.
0D:	Not used.
0E:	Not used.
0F:INIT EEP	Initializes the compensation value table.
10:	Not used.
11:AX OFST	Adjusts the AX offset values.
12:PRINT	Outputs general data such as compensation values (for inspection copies)
13:M-MODE	Model eye measurement mode (for measurement precision inspection).
14:D-SETUP	Sets the standard values for each intended area.
EXIT	Exits to the normal measurement screen temporarily. You must DIP switch No.1 to OFF after repair.

5－3 Test Program Descriptions

(1) TEST－00 : Checks the fogging sensor and switch settings and displays each voltage data.

```
00  SNS/SW
>EXIT


        SQARP1234
  SW    00000100 ←①
  FOG   =  L←②

     0←③    0←④    0←⑤    0←⑥
     7←⑦    6←⑧  154←⑨  101←⑩
```

(FIG. 5-2)

Description:
Allows you to check the keys function, DIP switch settings in the grip, FOG sensor state, AL and R/L signals, supplied voltage data, and chopper voltage data.

The values indicated by ① in the above figure show the DIP switch and operation key settings. "0" shows the OFF state and "1" shows the ON state.
The relation between the characters and the switches are shown below.

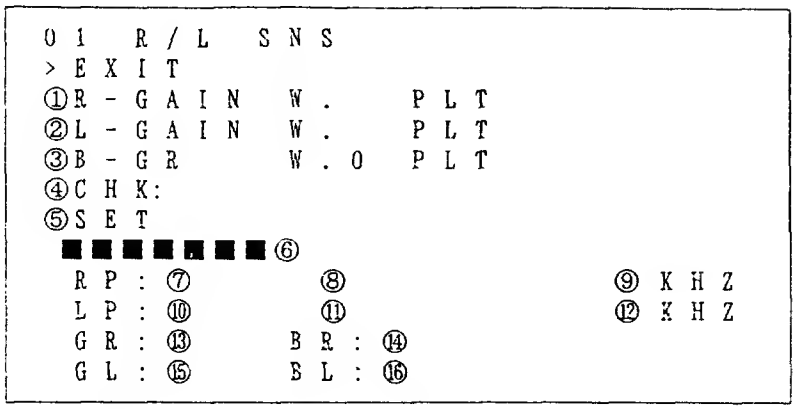
S:Start/Stop
Q:Quick
A:Angle
R:R/L
P:Print
1:DipSw-1
2:DipSw-2
3:DipSw-3
4:DipSw-4

The ② value shows the FOG sensor state ("L" shows the transparent state and "H" shows the occluded state).

The ③,④,⑤, and ⑥ values show voltage data for the photo detector unit alignment signal (AL1, AL2, AL3, and AL4).
NOTE: This function is not worked by ROM Ver. 1.21.

The ⑦ value shows voltage data for the R/L sensor signal at the R side.
The ⑧ value shows voltage data for the R/L sensor signal at the L side.
The ⑨ value shows voltage data for the battery or AC power.
This value is shown in the range of 148±6 when the voltage between the battery terminals is 6.0V.
The ⑩ value shows the chopper motor control voltage data.
This value usually fall in the range of 97 to 103. If the dispersion is +/-3 and the value does not fall in this range, the chopper sensor position might not be adjusted properly.
NOTE: This function is not worked by ROM Ver. 1.21.

(2) T E S T − 0 1 : Adjusts the R/L sensor.

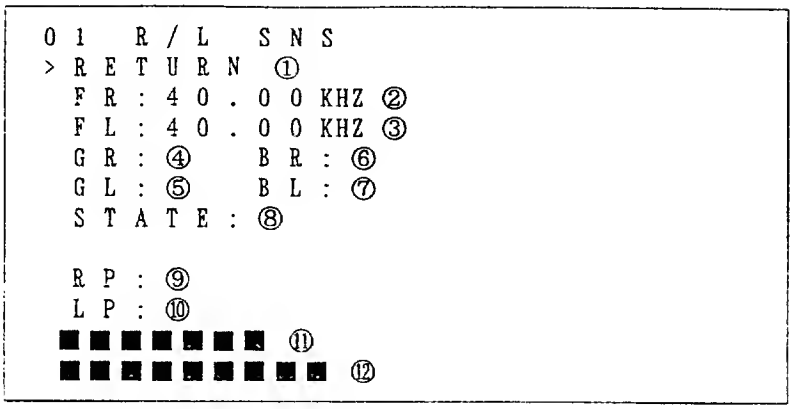


(FIG.5-3)

Description: Adjusts the R/L sensor sensitivity.

①: When you execute the test program at this position, the sensitivity measurement is started at the R side.
②: When you execute the test program at this position, the sensitivity measurement is started at the L side.
③: When you execute the test program at this position, the background level measurement is started.
④: When you execute the test program at this position, another mode appears to check that the sensor identifies a right or left eye properly. Refer to "Sub-items in TEST-01."
⑤: When you execute the test program at this position, compensation values are written into the EEPROM.
⑥: Bar graph which shows the sensitivity level.
⑦: Shows the R-side sensor level (255 at maximum)
⑧: Shows the highest sensor level in the R side.
When you execute the test program at the ① position, the sensitivity measurement software is started to indicate the highest R-side sensor level of the scanned frequencies.
⑨: Shows the frequency with which the R-side sensor transmits signals. The program scans the frequency at 40.00 for the first time and in the range of 39.00 to 41.00 during sensitivity measurement. These two scans determine the maximum frequency to be indicated on the screen.
⑩: Shows the L-side sensor level (255 at maximum).
⑪: Shows the L-side highest sensor level.
When you execute the test program at the ② position, the sensitivity measurement software is started to indicate the highest L-side sensor level of the scanned frequencies.
⑫: Shows the frequency with which the L-side sensor transmits signals. The program scans the frequency at 40.00 for the first time and in the range of 39.00 to 41.00 during sensitivity measurement. These two scans determine the maximum frequency to be indicated on the screen.
⑬: Shows the R-side sensor sensitivity measured in Step ①.
⑭: Shows the R-side background level measured in Step ③.
⑮: Shows the L-side sensor sensitivity measured in Step ②.
⑯: Shows the L-side background level measured in Step ③.

(3) Sub-items in TEST-01:
Checks and further refines the R/L sensor adjustment.

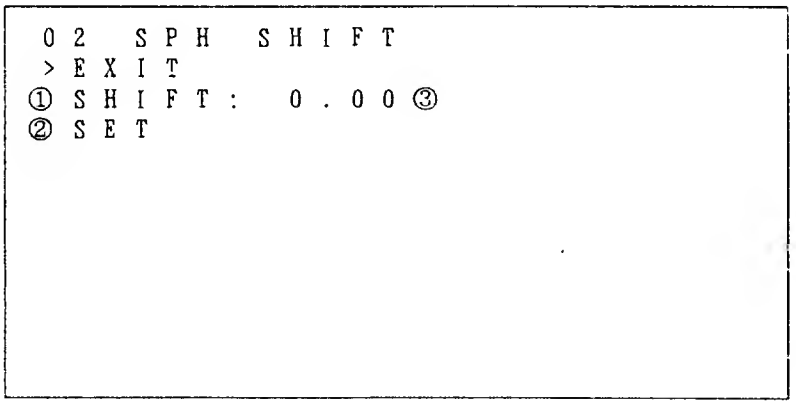


(FIG.5-4)

Description: Allows you to check the sensor operation and further refine the sensitivity adjustment.

①: When you move the cursor (>) to this position and execute the test program, the previous screen is displayed again.
②: Shows a frequency at the right side. You can move the cursor to FR and press the R/L or PRINT key to change the frequency.
③: Shows a frequency at the left side. You can move the cursor to FL and press the R/L or PRINT key to change the frequency.
④: Shows a gain value at the right side. You can move the cursor to GR and press the R/L or PRINT key to change the gain value.
⑤: Shows a gain value at the left side. You can move the cursor to GL and press the R/L or PRINT key to change the gain value.
⑥: Shows a right-side background noise value.
⑦: Shows a left-side background noise value.
⑧: Shows the character "R" or "L" according to a signal transmitted from the R/L sensor. If the program cannot identify which character to indicate, it shows ■.
⑨: Shows a compensated power at the right side.
⑩: Shows a compensated power at the left side.
⑪: Bar graph which shows a sensitivity at the right side.
⑫: Bar graph which shows a sensitivity at the left side.

(4) TEST-02: Parallel shifting of the spherical power



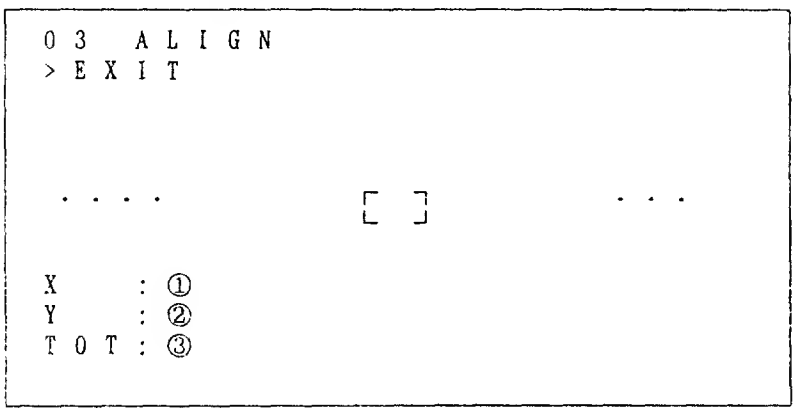
(FIG.5-5)

Description: Allows you to change spherical power for compensation.
①: When you move the cursor (>) to this position and each press of the R/L key changes the power displayed on the ③

②: When you execute the test program at this position, compensation values are written into the EEPROM.

NOTE: This function is not worked by ROM Ver. 1.21.

(5) T E S T − 0 3 : Checks and adjusts unit alignments.

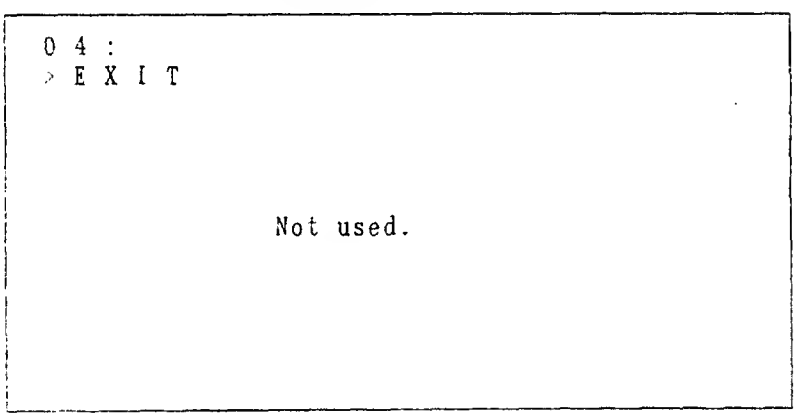


(FIG.5-6)

Description.
This test has no item to execute and only displays alignment data.

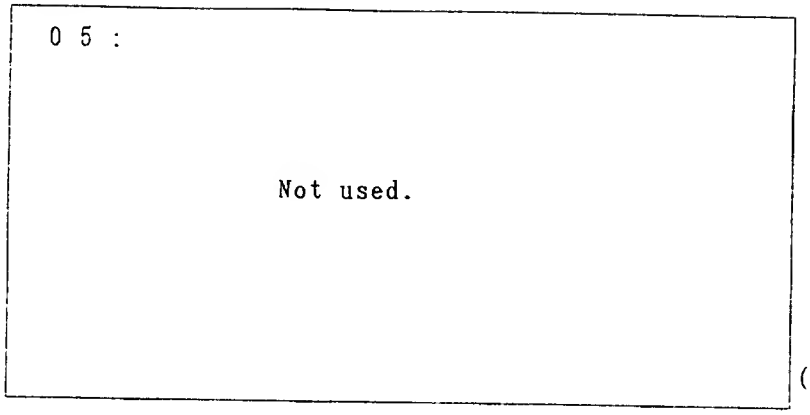
①: XAL alignment data
②: YAL alignment data
③: TOT value: The reference value is 190±30 (adjusted with VR4 on the CPU board). (Ref. 8-6-4)

(6) T E S T − 0 4 : Not used.



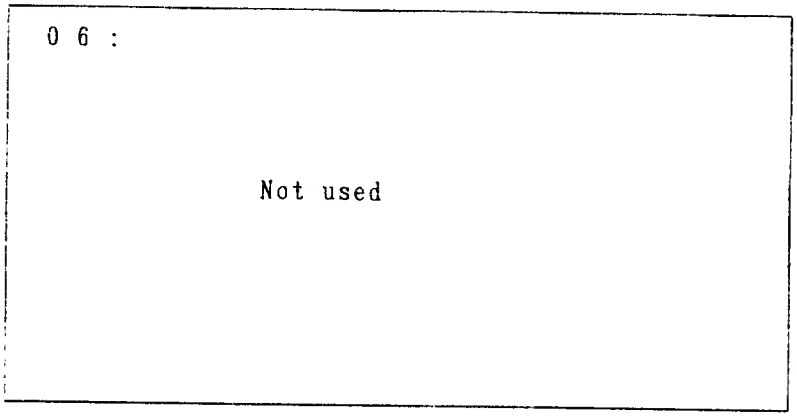
(FIG.5-7)

(7) T E S T − 0 5 :　　Not used.



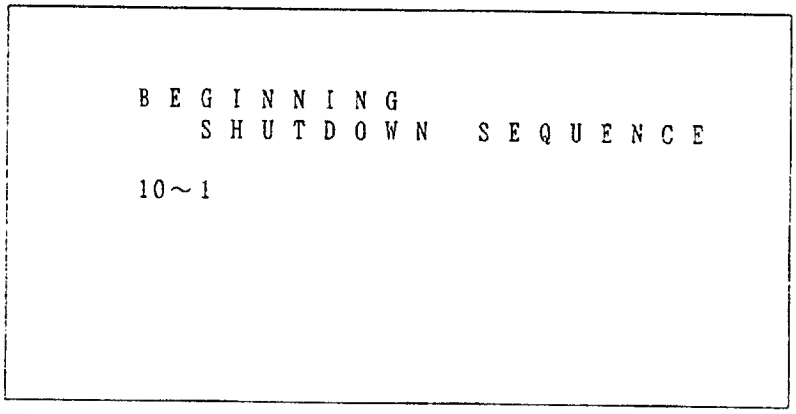
(FIG.5-8)

(8) T E S T − 0 6 :　　Not used.



(FIG.5-9)

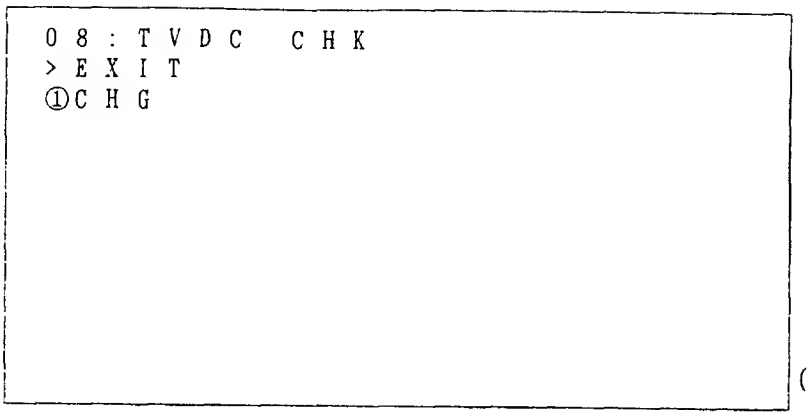
(9) T E S T − 0 7 : Checks the automatic power saving function.



(FIG.5-10)

Description: Allows you to check that the automatic power saving function is executed automatically. When you run TEST-07, the Retinomax power is turned off automatically after 10 seconds.

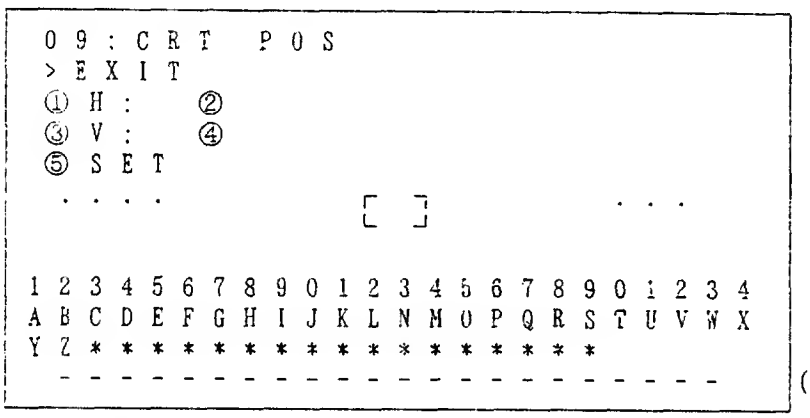
(10) T E S T − 0 8 : Checks the TVDC.



(FIG.5-11)

Description:
Generally checks that the TVDC functions properly.
When you execute this test program at the ① position, the program repeats normal and reverse character displays alternately.

(11) T E S T − 0 9 : Adjust the character positions.



(FIG.5-12)

Description: Adjusts the character positions on the view finder.

①: When you press the R/L or PRINT key at this position, the compensation value ② is changed and the character moves in the right or left.

③: When you press the R/L or PRINT key at this position, the compensation value ④ is changed and the character moves upward or downward direction.

⑤: When you execute the test program at this position, the above compensation values are written in EEPROM.

You can adjust VC1 on the CPU board to adjust the character width.
You must adjust the TEST-09 whenever you replace the CPU board.
(Ref. 8-4-4)

(12) T E S T − 0 A : Adjust and writes fogging offset values.

```
0 A : F O G   O F S T
> E X I T
①  S T E P : 0 0 2 5  ⑦
②    0 D P     ⑧
③  1 0 D P     ⑨
④- 1 0 D P     ⑩
⑤  S E T


    P O S : ⑥

   P : S T A R T   - : P R I N T
```

(FIG.5-13)

Description: Adjusts the fixation target focus.

①: When you execute the test program at this position, the fixation target moves based on 025, 050, 075, and 100 steps in that order and the current step is shown in the ⑦ position.

②: When you execute the test program at this position, the fixation target moves to the 0DP position.

③: When you execute the test program at this position, the fixation target moves to the +10DP position.

④: When you execute the test program at this position, the fixation target moves to the -10DP position.

⑤: When you execute the test program at this position, the compensation values are written in EEPROM.

⑥: Shows the current fixation target position.

⑦: Shows the current movement step.

⑧: Shows the compensation value at 0DP.

⑨: Shows the compensation value at +10DP.

⑩: Shows the compensation value at -10DP.

When you want to increase the compensation value, press the READY SWITCH on the grip. Each time you press this key, the compensation value increases by the step value shown at the ① position.

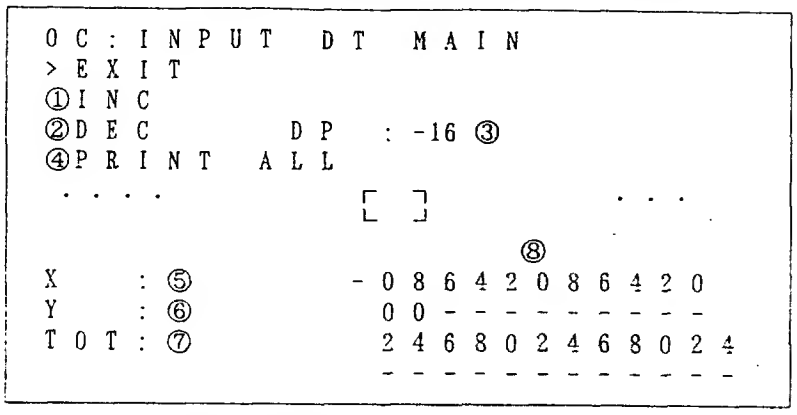
When you want to decrease the compensation value, press the PRINT KEY. Each time you press this key, the compensation value decreases by the step value shown at the ① position.

(13) T E S T − 0 B : Not used.

```
0 B :

              Not used.
```

(FIG.5-14)

(14) T E S T − 0 C : Adjust the sph. and cyl. powers



(FIG.5-15)

①: When you execute the test program at this position, 2 is added to the diopter value for the model eye. Current diopter value is shown in the ③ position.

②: When you execute the test program at this position, 2 is subtracted from the diopter value for the model eye. Current diopter value is shown in the ③ position.

④: Prints all the compensation values of TEST-0C.
⑤: Shows X alignment.
⑥: Shows Y alignment.
⑦: Shows TOT value.
⑧: When you write the compensation values, the indication changes from (-) to (0).

Each number of -08642086420 represents the last digit diopters for model eyes to be compensated. In this example, these numbers correspond to -20D, -18D, -16D, -14D, -12D, -10D, -8D, -6D, -4D, -2D, and 0D, respectively.

However, note that all the displays return to (-) when "EXIT" is executed during the TEST-0C adjustment.

Figure 5-15 shows that the compensation values ranging from -20D to -16D are written in EEPROM. The compensation is done for the values ranging from -20D to -24D.

(15) S u b − i t e m s i n T E S T − 0 C :

Displays model eye measurement data obtained in TEST-OC

```
0 C : I N P U T   D T   S U B
①R E T U R N
②S E T
③P R I N T          ⑰

      H 1 : ④              V 1 : ⑩
      H 2 : ⑤              V 2 : ⑪
      H 3 : ⑥              V 3 : ⑫
      H 4 : ⑦              V 4 : ⑬
      D X : ⑧              D Y : ⑭
      L X : ⑨              L Y : ⑮
                           D F : ⑯
```

(FIG.5-16)

Description:

Displays values measured in TEST-OC. When you press the READY KEY, the measurement is taken again and the new values are displayed.

①: When you execute the test program in this position, the previous screen is displayed again.

②: When you execute the test program in this position, the measurement values are written in EEPROM as the compensation values. Then the previous screen is displayed again and 2D is added to the DP value for the corresponding model eye.

③: When you execute the test program in this position, prints only the compensation values corresponding to the current diopter.

④: Shows the count value for H1.

⑤: Shows the count value for H2.

⑥: Shows the count value for H3.

⑦: Shows the count value for H4.

⑧: Shows the count value for DX.

⑨: Shows the count value for DELX.

⑩: Shows the count value for V1.

⑪: Shows the count value for V2.

⑫: Shows the count value for V3.

⑬: Shows the count value for V4.

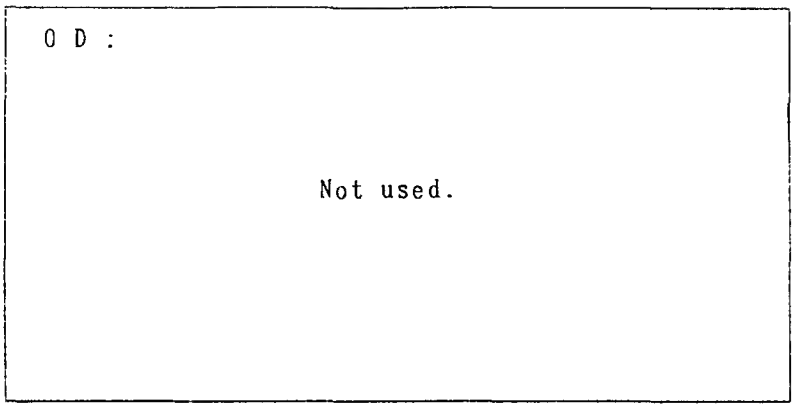
⑭: Shows the count value for DY.

⑮: Shows the count value for DELY.

⑯: Shows the deflection width for DX÷DY.

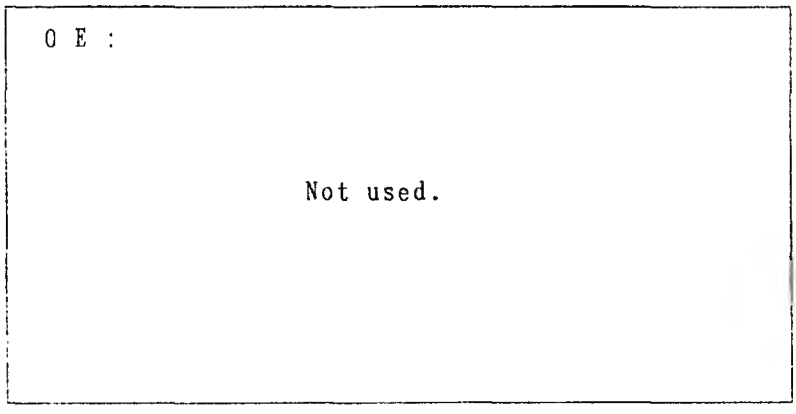
⑰: Current diopter value is shown.

(16) T E S T − 0 D :　　Not used.



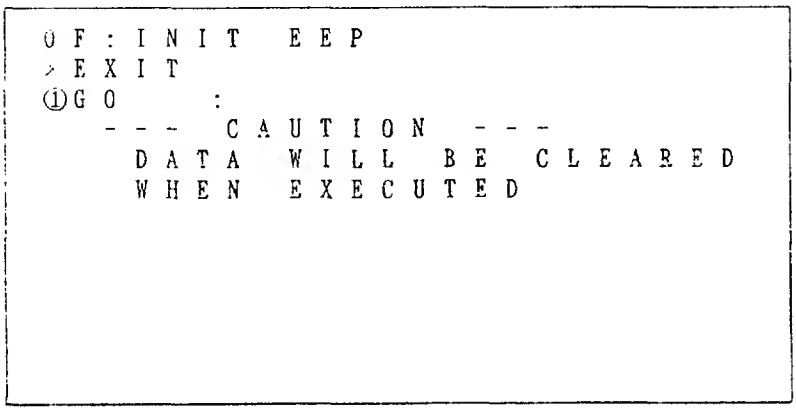
(FIG.5-17)

(17) T E S T − 0 E :　　Not used.



(FIG.5-18)

(18) T E S T − 0 F : Initializes the compensation value table.



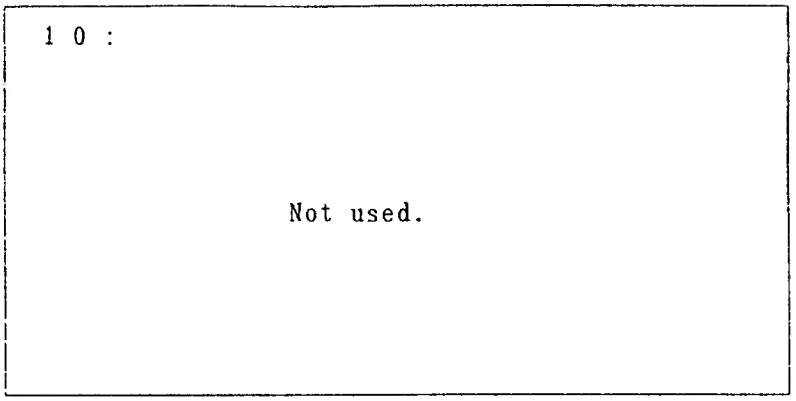
(FIG.5-19)

Description:

①: When you execute the test program at this position, the compensation value area in EEPROM is initialized to the standard settings. Especially when you replace the cpu board, you should execute this program to initialize EEPROM for avoiding malfunctions during an adjustment.

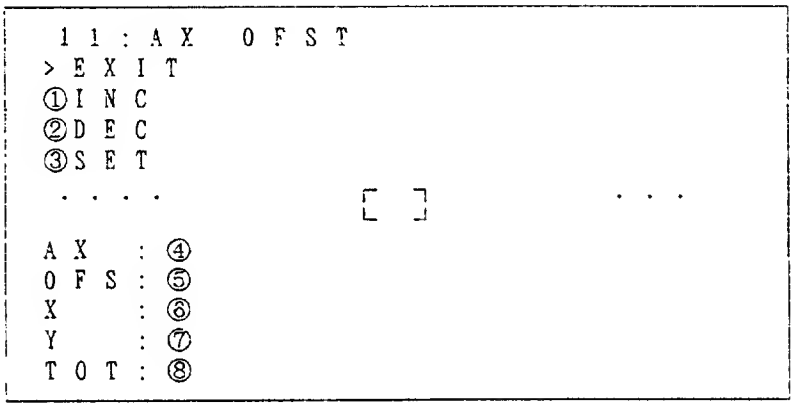
Note: If you execute the TEST-0F on an adjusted equipment, <u>all compensation data is deleted.</u> Therefore, you must execute this program only when it is needed.

(19) T E S T − 1 0 :　　Not used.



(FIG.5-20)

(20) T E S T − 1 1 : Adjusts the AX offset value



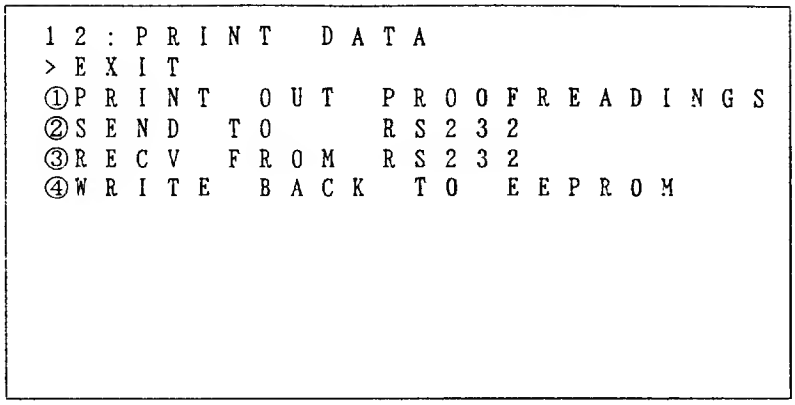
(FIG.5-21)

Description:

This test makes measurements on the astigmatism model eye mounting attachment and find the compensation value to be used to calibrate the cylindrical axis of the Retinomax. Measuring the reference astigmatism model eye mounting attachment in a good alignment condition causes the cylindrical axis (-CYL) read-out to be displayed in (4). Increase or decrease the AX offset so that the read value in (4) equals the correct value.

①: Execute the test program at position ①, and the cylindrical axis will be incremented by 1.
②: Execute the test program at position ②, and the cylindrical axis will be decremented by 1.
③: Execute the test program at position ③, and the compensation value displayed at position ⑤ will be saved into the EEPROM.
④: represents the cylindrical axis.
⑤: represents the cylindrical axis compensation value.
⑥: represents the X alignment.
⑦: represents the Y alignment.
⑧: represents the TOT value.

(21) T E S T − 1 2 : Printing (inspection memorandums)



(FIG.5-22)

Description:

①: When you execute the test program at position ①, you can print the compensation values that are defined in the test programs as inspection memorandums.

Data printed:

R/L sensor compensation value (01)
Character position compensation value (09)
Automatic fogging focus compensation value (0A)
Model eye compensation value (0C)
Cylindrical axis compensation value (11)

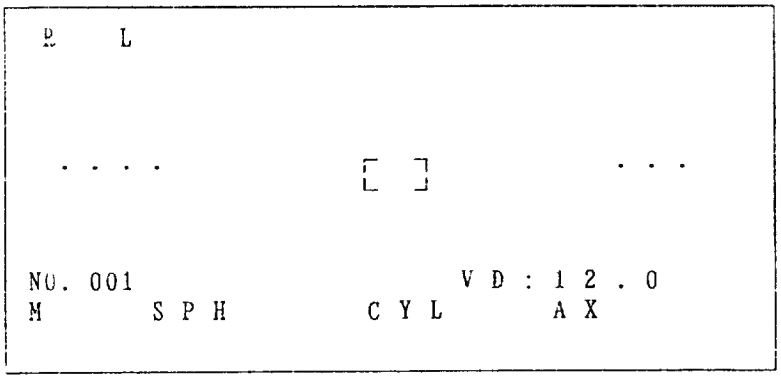
②: When you execute the test program at position ②, you can send the compensation values to the personal computer via an RS232C interface.

③: When you execute the test program at position ③, you can received the compensation values from the personal computer via an RS232C interface.

④: Execute the test program at position ③, and the received compensation values from PC will be saved into the EEPROM.

NOTE: The ③④ function are not worked by ROM Ver. 1.21.
See the chapter 13 for detail.

(22) T E S T − 1 3 :
Normal measurement in the model eye mode (for model eye inspection)



(FIG.5-23)

Description:

The model eye mode is entered. When performing a precision inspection using a model eye, be sure to execute this program before the precision inspection. You can print the measurement results as in the normal mode. Note, however,

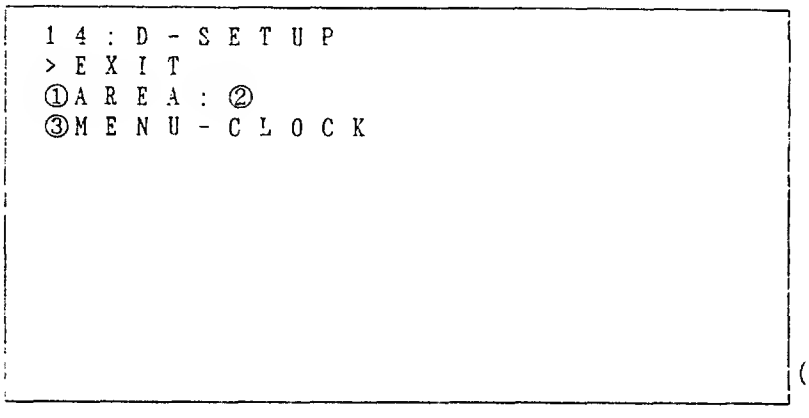
that the R/L display is set to "M" because neither R nor L sensors are enabled.

Procedure for returning to the test program.
Note that this procedure differs depending on the ROM version.

(ROM Ver. 1.21) Turn off the power, then turn on the power while holding down the Start switch.

(ROM Ver. 1.22～) ① Set to (- STAND BY -) screen.
② Press the R/L key to return to the test program's menu screen.

(23) T E S T − 1 4 : Setting up the standard values for the destination



(FIG.5-24)

Description:
①: Execute the test program at position ①, and the destination areas will appear at position ② cyclically (JAPAN → USA → EUROPE).

	JAPAN	USA	EUROPE
V D	12.0	13.75	12.0
Date format	YMDT	MDYT	DMYT

Change the setting, and the current VD and date settings will be defined.

③: When you execute the test program at position ③, the new screen will appear on which you can set the date and time.
See the TEST-14-subitem on next page.

NOTE: Patient's number is set to "001" when TEST-14 is executed.

(24) Sub-items in TEST-14 : Date and time setup

```
  C L O C K      ⑨'95.03.15. 11:23 AM
> E X I T
①S E T  A N D  E X I T
②D A T E - F O R M : Y M D T⑩
③T I M E - F O R M : A M / P M⑪


④M I N U T E
⑤H O U R
⑥D A Y
⑦M O N T H        / R/L    :INC /
⑧Y E A R          / PRINT  :DEC /
```

(FIG.5-25)

Description:

①: Execute the test program at position ①, and the date and time will be saved and the previous screen restored.

②: Execute the test program at position ②, and the format of the date and time that are being displayed at ⑩ will be changed (YMDT → MDYT → DMYT).

③: Execute the test program at position ③, and the hour system of the time that is being displayed at ⑪ will be changed (AM/PM → 24H).

④: Position the cursor at position (4) and press either R/L key (increment) or PRINT key (decrement), and you can change the minutes value displayed at ⑨.

⑤: Position the cursor at position ⑤ and press either R/L key (increment) or PRINT key (decrement), and you can change the hours value displayed at ⑨.

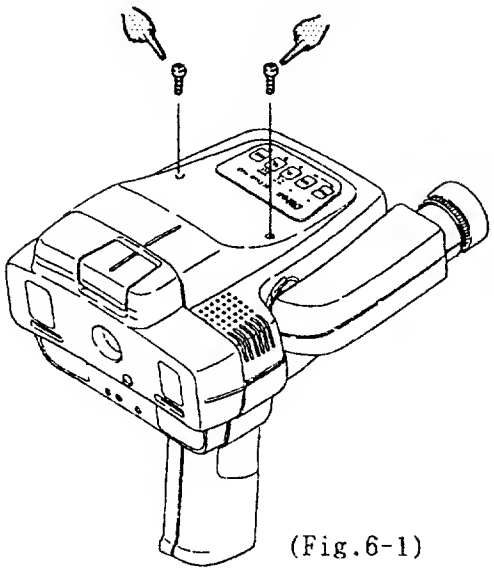
⑥: Position the cursor at position ⑥ and press either R/L key (increment) or PRINT key (decrement), and you can change the days value displayed at ⑨.

⑦. Position the cursor at position ⑦ and press either R/L key (increment) or PRINT key (decrement), and you can change the months value displayed at ⑨.

⑧: Position the cursor at position ⑧ and press either R/L key (increment) or PRINT key (decrement), and you can change the years value displayed at ⑨.

6 Removing the Main body Cover

6－1 Removing the Top Cover

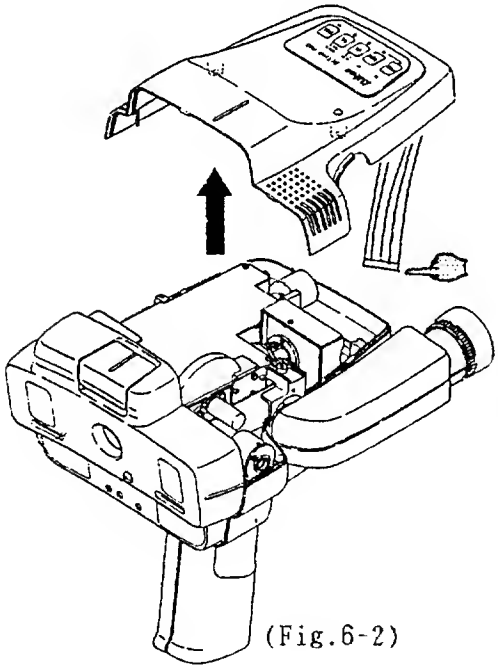


(Fig.6-1)

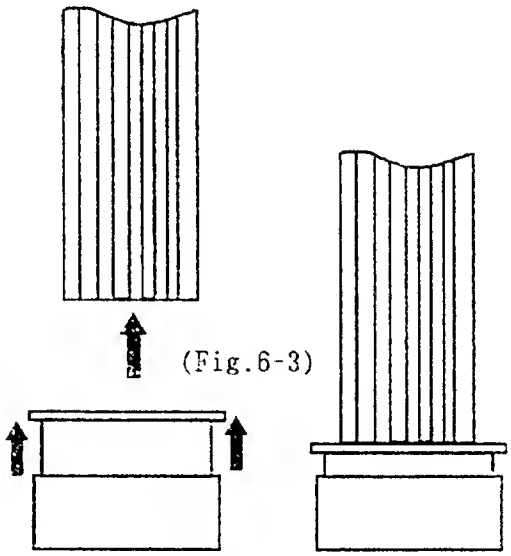
① Remove two screws.

(See fig. 6-1)

② Remove the top cover as shown in the fig. 6-2.



(Fig.6-2)

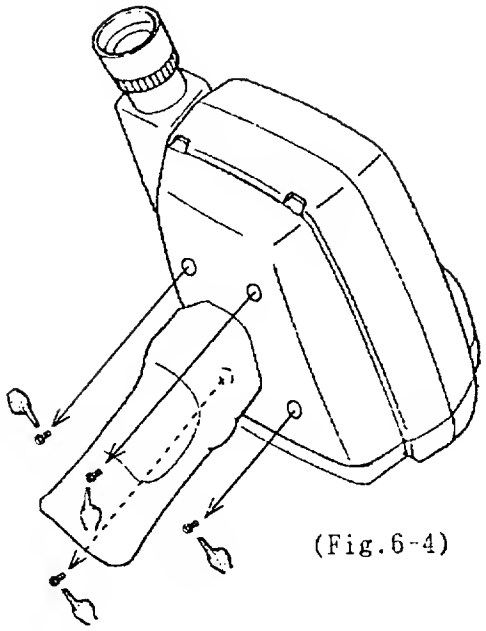


(Fig.6-3)

③ Disconnect the flat cable from the connecter on analog board. (See fig. 6-2,-3)

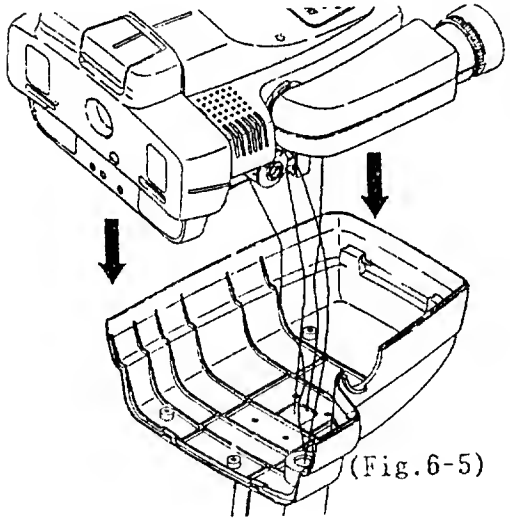
Note: If it is hard to disconnect, remove the bottom cover to loosen the flat cable connector first.

6 - 2 Removing the Bottom Cover



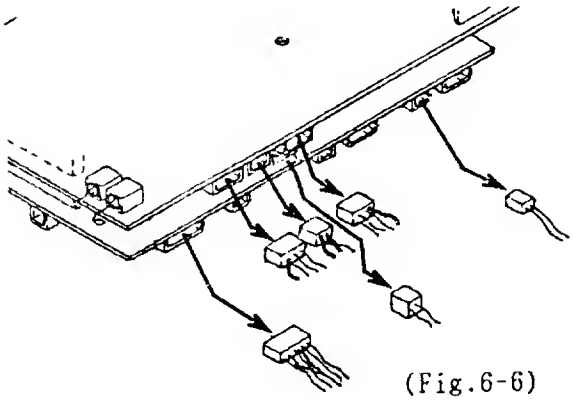
(Fig.6-4)

① Remove four screws.
(See fig. 6-4)



(Fig.6-5)

② Remove the bottom cover as shown in the fig. 6-5.

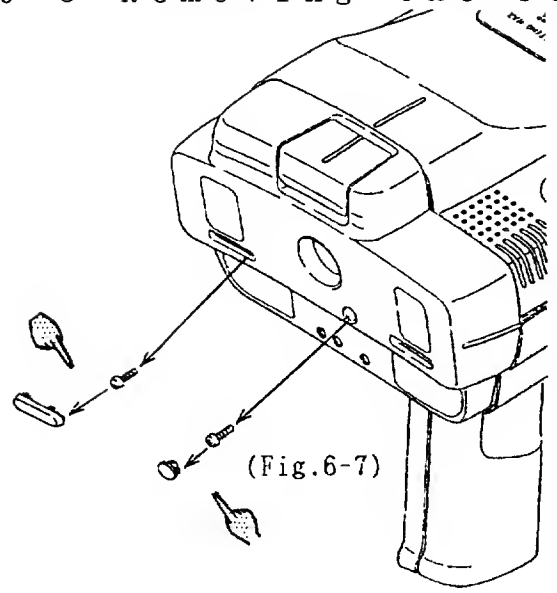


(Fig.6-6)

③ Disconnect the cables.

(See fig. 6-6)

6－3 Removing the Front Cover

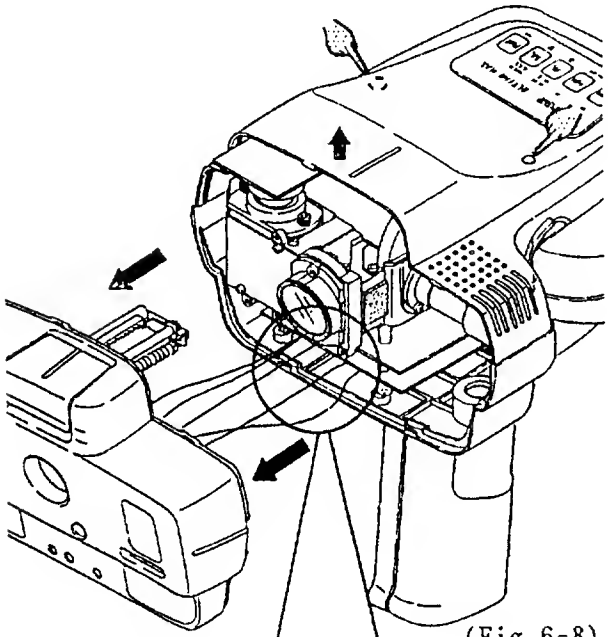


(Fig.6-7)

① Remove the screw hole covers.

② Remove two screws.

(See fig. 6-7)

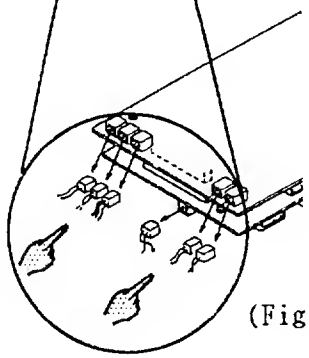


(Fig.6-8)

③ Loosen two screws on the top cover.

(See fig. 6-8)

④ Remove the front cover as shown in the figure to the left.



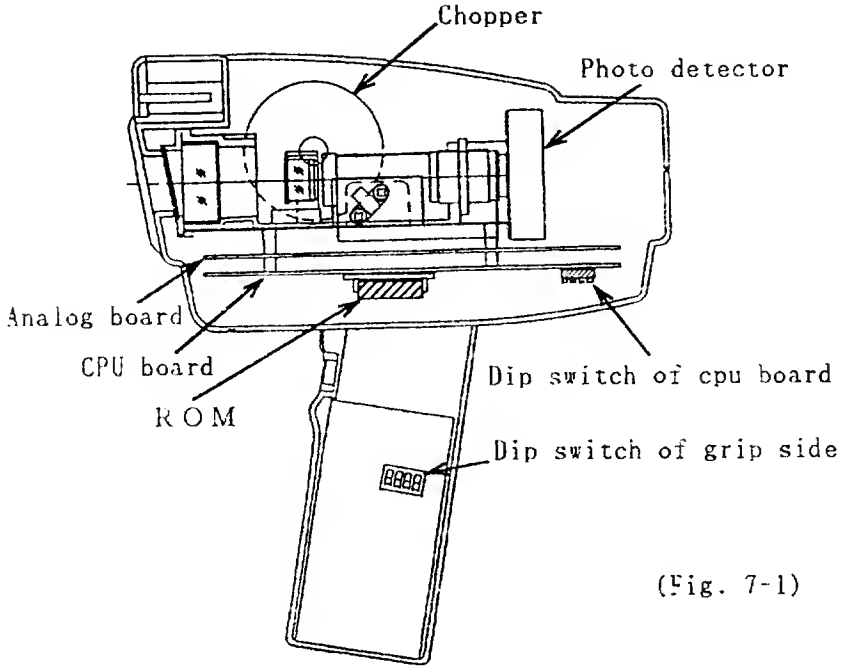
(Fig.6-9)

⑤ Disconnect the cables.

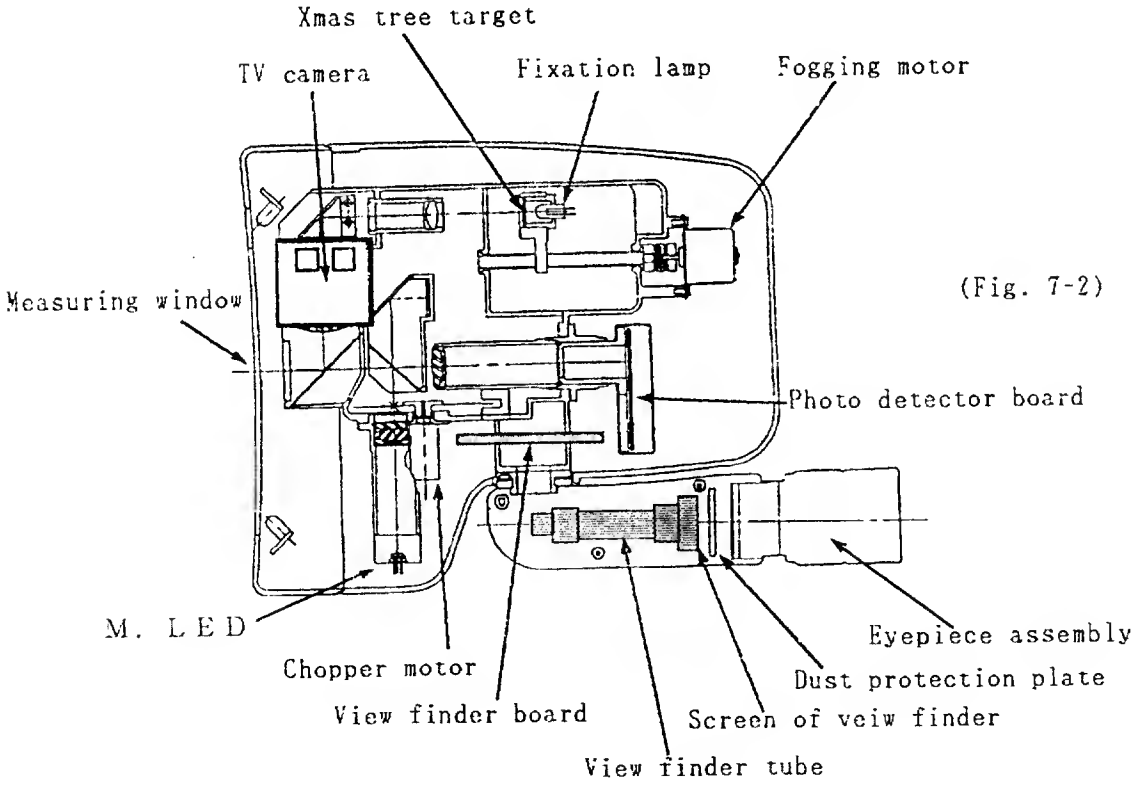
(See fig. 6-9)

7 Replacing the Electrical Boards

7-1 Board and Electrical Component Locations



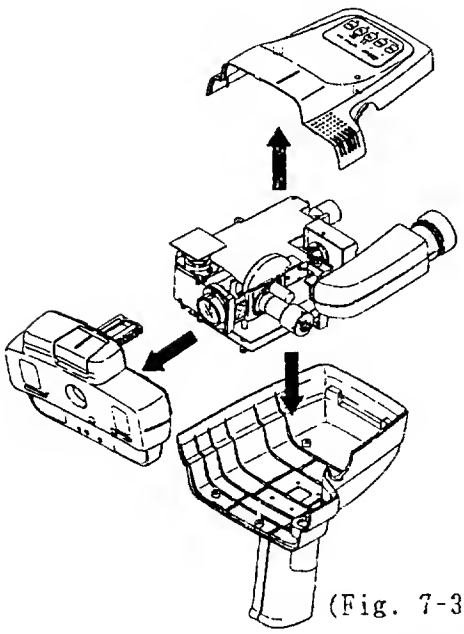
(Fig. 7-1)



(Fig. 7-2)

7-2 Replacing the CPU board

① Print out the compensation data.
Execute the TEST-12 program and move the cursor (>) to "PRINT OUT PROOFREADINGS" and press the R/L key.



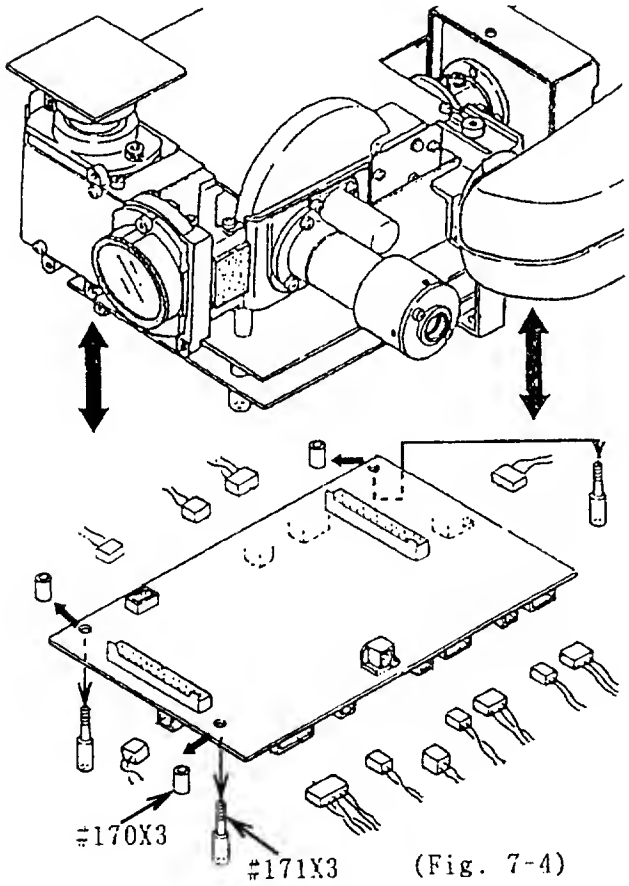
(Fig. 7-3)

NOTE :

If you have personal computer(PC), the compensation data can be saved via an RS232C interface, then the data can be rewritten after replacing the cpu board. Using pc can work easily when the cpu board is exchanged.

(See Chapter 13)

② Remove the front, top, and bottom covers (See Sections 6-1, 6-2, and 6-3).



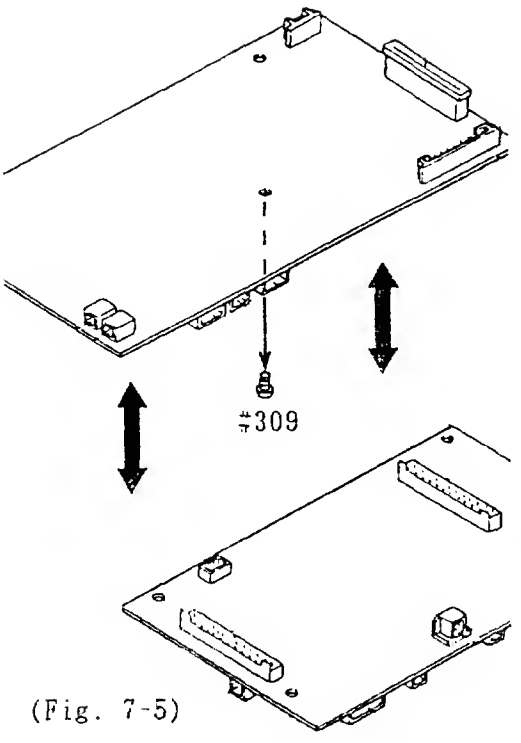
(Fig. 7-4)

③ Disconnect cables from the CPU board.

④ Remove three board mounting screws and three spacers, and you can remove the CPU board.

⑤ Remove only the CPU board.

Caution:
The analog board is secured by another board securing screw (#309) and you cannot remove it after removing the three screws.



(Fig. 7-5)

⑥ Replace the new CPU board.
⑦ Remove the ROM chip from the old CPU board and reinstall it on the new CPU board.
⑧ Install the CPU board and cables in the reverse order of disassembly.

⑨ While referring to Subsections
8-4-4, Adjusting the Character Position,
8-4-5, Adjusting the Contrast and Outline,
8-6-4, Adjusting TOT,

manipulate the potentiometers VC1, VR1, VR2, and VR4 on the CPU board and adjust the character positions. You need not adjust VR3.

NOTE:
When the compensation data is saved with a personal-computer, the steps(⑩) to (⑬) need not be done. Rewrite the compensation data saved with the PC in Retinomax when the step (⑧) is completed.(See section 13-3) Perform steps (⑨) and (⑭) when rewrite the data.

⑩ While referring to TEST-11, Adjusts the AX offset values, adjust the compensation data (11 DATA AX offset: ***) that is printed out in ① into EEPROM.

⑪ While referring to TEST-0A, Adjusts the fogging offset values, adjust the compensation data (0A DATA -10D: *** 0D: *** +10D: ***) that is printed out in ① into EEPROM.
⑫ Calibrate the spherical and cylindrical powers while referring to Subsection 8-7-2.
⑬ Calibrate the R/L sensor sensitivities while referring to Subsection 8-8-3.
⑭ Attach the covers and perform the quick inspection explained in Section 3-1. The replacement procedure is considered to be completed if no other error is detected.

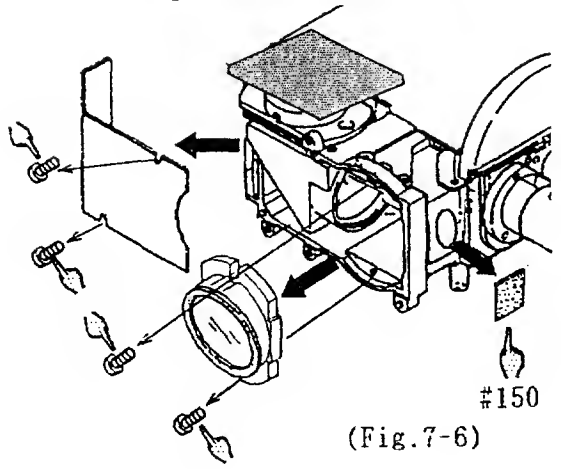
7 – 3 Replacing the Analog Board

① Remove the CPU board while referring to steps ① to ⑤ in Section 7-2, Replacing the CPU Board.
② Disconnect all cables from the analog board. Remove another securing screw (#309) from the analog board and replace it with the new one.
③ Reinstall the analog board and cables in the reverse order of disassembly.
④ You must calibrate the spherical, cylindrical powers and the R/L sensor sensitivities once you replaced the analog board.

Refer to Subsection 8-7-2 when calibrating the spherical and cylindrical powers.
Refer to Subsection 8-7-3 when calibrating the cylindrical power.
Refer to Subsection 8-8-3 when calibrating the R/L sensor sensitivities.

⑤ Attach the covers and perform the quick inspection explained in Section 3-1. The replacement procedure is considered to be completed if no other error is detected.

7-4 Replacing the photo detector board



(Fig.7-6)

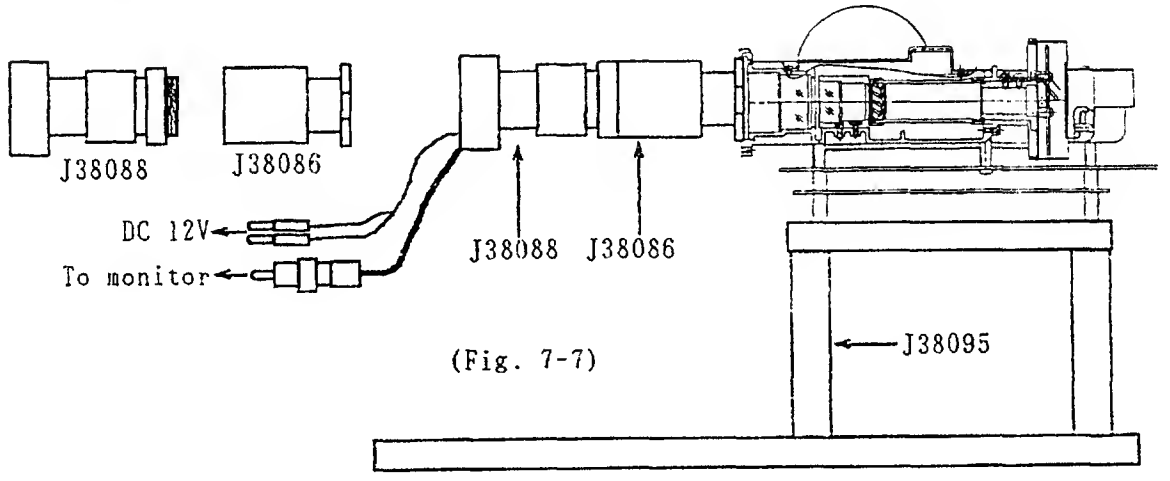
① Remove the top, bottom, and front covers. Mount the Retinomax main body on the optical adjustment stand (J38095).

NOTE: Keep the cables connected.

② Remove the dust-proof glass assembly (G1,148,177), dust-proof cover(#143)

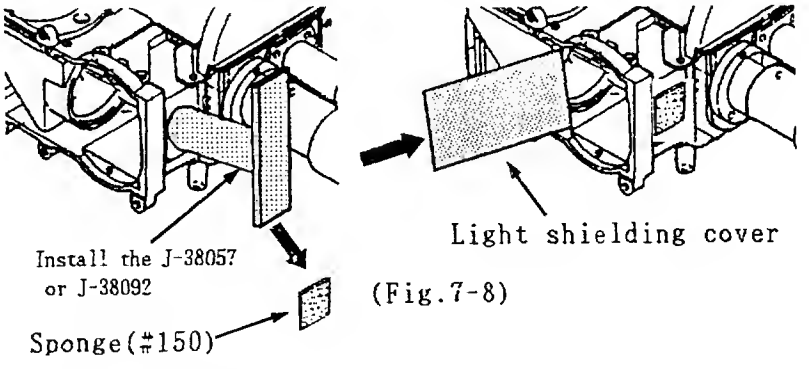
③ Remove the sponge(#150) located on the side of the measurement window. (see Figure 7-6).

④ Install the adapter tool(J35086) and TV camera tool(J38088) in the measurement window.
(see Figure 7-7).



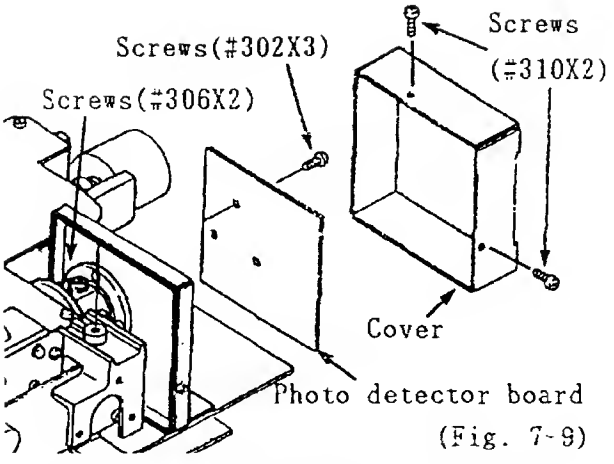
(Fig. 7-7)

⑤ Direct the light of an illuminating LED attachment(J38057) or (J38092) into the photo detector.
Insert a light-shielding cover to screen unnecessary light off the light channel of the fixation target. (See Fig.7-8)



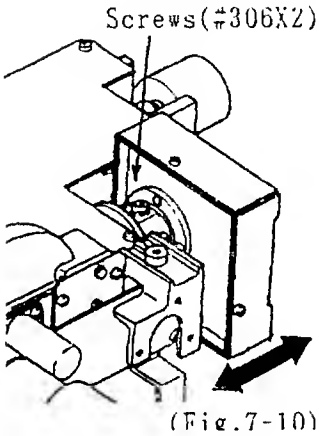
(Fig.7-8)

⑥ Remove the cover(#120) from the photo detector and disconnect the cable to the photo detector (J3 on the analog board).



(Fig. 7-9)

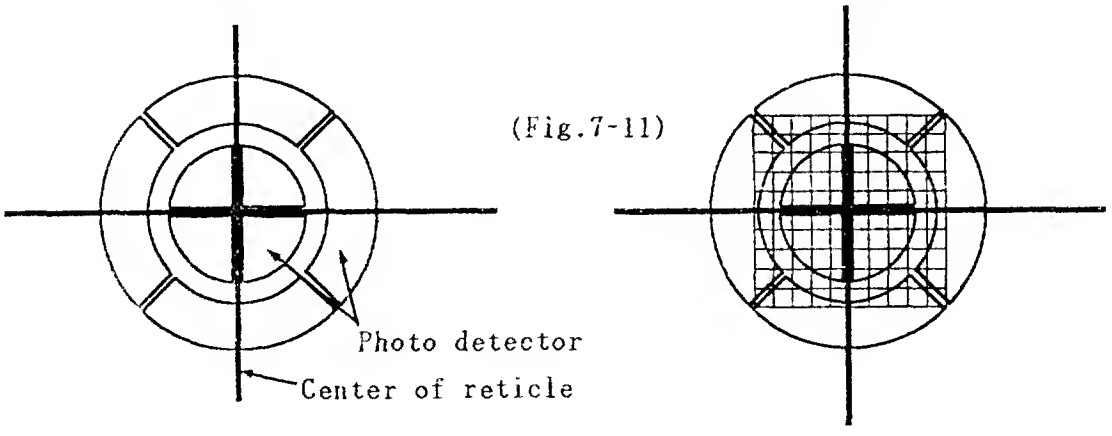
⑦ Remove the board mounting screws(#302) and replace with the photo detector with the new one. (See Figure 7-9).



(Fig.7-10)

⑧ When the photo detector focus is off.
Loosen the screw (#306) and slide back and forth the PCB mount assembly(A1,119) on which the photo detector board is mounted so that the board is in focus (See Figure 7-10).

⑨ Loosen the mounting screws(#302) in the board and adjust the position of the photo detector board so that the center of the photo detector board is aligned with the center of the reticle of the TV camera tool.
(See Figure 7-10,-11). (Limit of tolerances 0.5 grads)



(Fig.7-11)

⑩ Mount the cover on the photo detector board. Plug the photo detector board cable into J3 of the analog board.
⑪ Remove the illuminating LED. Place the dust-proof glass, dust-proof cover and sponge.

⑫ Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

⑬ Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

⑭ Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

⑮ Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

⑯ Place the all covers and perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

7 – 5 Replacing the TV Camera

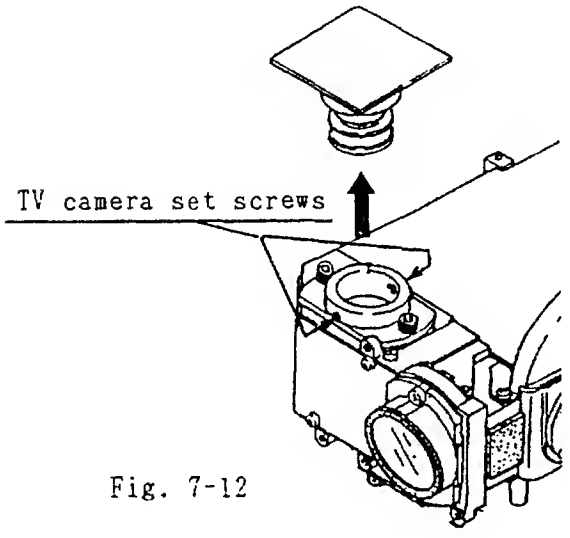


Fig. 7-12

① Remove the top, bottom, and front covers while referring to Sections 6-1, 6-2, and 6-3.

② Loosen two set screws and remove the camera. (See fig. 7-12)

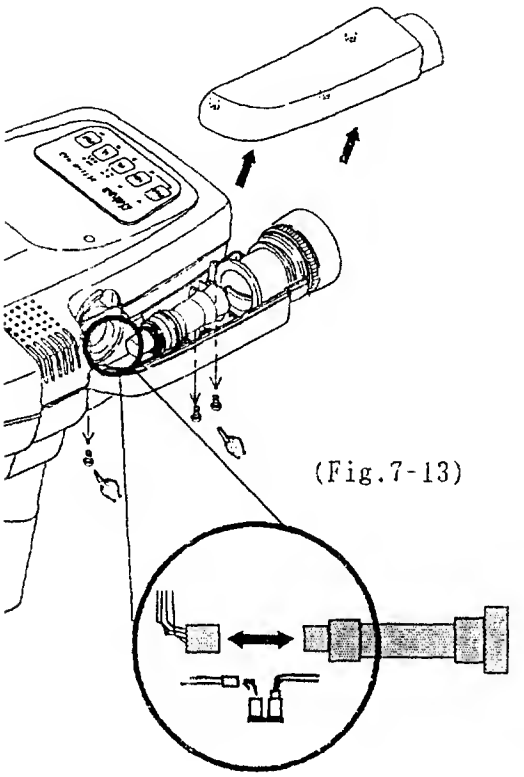
③ While referring to:
Subsections 8-6-2, Focusing and Adjusting the Tilt of the TV Camera
Subsections 8-6-3, Adjusting the TV Camera Position(alignment),

adjust the focus, tilt and position of the TV Camera.

7-6 Replacing the View Finder and View Finder PCB

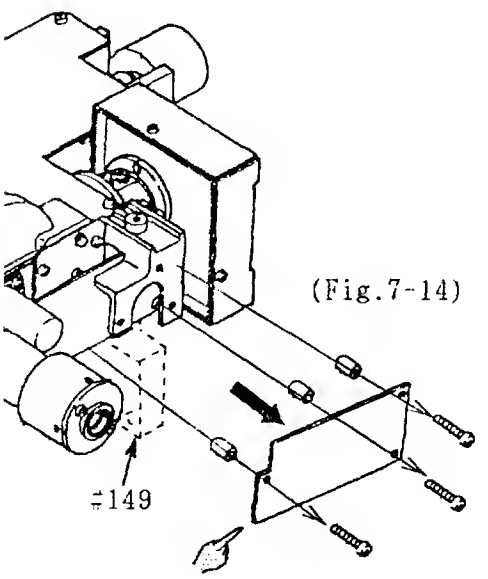
Caution:

The view finder and view finder PCB must be replaced at the same time. These parts are always supplied in pair. Since the variable resistors on the view finder PCB are preadjusted, they must never be replaced with other same parts or their position must never be changed.



(Fig.7-13)

① While referring to steps ② to ⑤ in Section 7-2, Replacing the CPU Board, remove the body cover and CPU board.
② Disconnect all cables from the analog board. Remove the securing screw (=309) and the analog board. (See fig. 7-5)
③ Remove the bottom cover mounting bracket (=149). (See fig. 7-14)
④ Remove three screws from the view finder cover. (See fig. 7-13)
⑤ Remove the top cover from the view finder.
⑥ Lift and remove the view finder unit and disconnect the cable from the finder (See fig. 7-13. Unplug two connectors).
⑦ Remove three screws and three spacers from the view finder board.(See fig. 7-14)
⑧ Replace the view finder PCB with the new one and thread the cable through the cable hole. Mount the three securing screws and three spacers on the view finder board.
⑨ Install the new view finder with the red mark facing up.
⑩ Place the top cover on the view finder with the three cover screws.

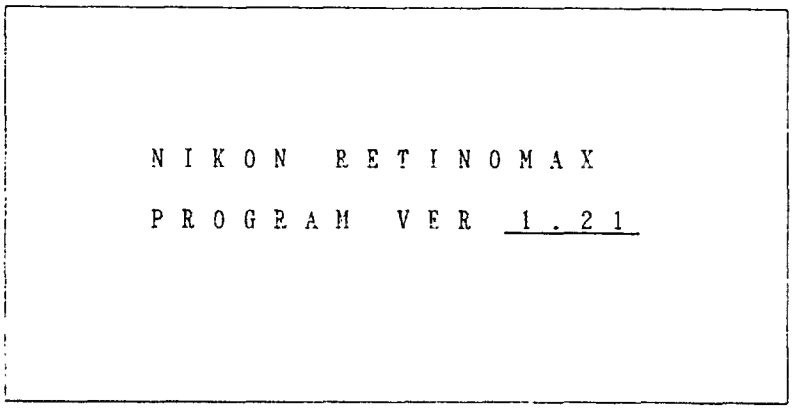


(Fig.7-14)

⑪ Assemble the view finder in the reverse order of disassembly.
⑫ Connect the keyboard flat cable from the top cover to J3 on the analog board and set the view finder ready for operation.
⑬ Perform the view finder inspection according to the instructions in Subsection 8-4-1. If any problem is found on the finder screen, make necessary adjustments according to the instructions given in Subsections 8-4-4, Adjusting the Character Position, and 8-4-5, Adjusting the Contrast and Outline.
⑭ Place the top, bottom, and front covers on the main body. Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

7 – 7 ROM
(Identifying the ROM Version and Replacing the ROM Chip)

· Identifying the ROM version:
When you turn on the unit, the following message appears on the view finder screen: "VER 1.21" represents the version number of the ROM.



(FIG. 7-15)

Replacing the ROM chip:

① Remove the battery and make sure that the unit power is off (important).
② Locate the ROM chip in Figure 7-1 in Section 7-1, Board and Electrical Component Locations. Remove the bottom cover while referring to Section 6-2, Removing the Bottom Cover.
③ Remove the ROM chip from the CPU board and replace it with the new ROM VER.
④ Replace the bottom cover. You do not need to make any adjustment after replacing the ROM chip.

ROM SIZE: 1M bit (common to NRK-8000)
Part No. DDA30000 #601(2) 3S162-017

7 – 8 Variable resistors list

① Variable resistors on the CPU board
VR1: To adjust the outline of the characters on the view finder screen. (Ref. step 8-4-5)
VR2: To adjust the contrast of the view finder screen. (Ref. step 8-4-5)
VR3: Not used.
VR4: To adjust TOT (190 ±30). (Ref. step 8-6-4)

VC1: To adjust the width of the view finder screen. (Ref. step 8-4-4)

② Variable resistors on the view finder control board
VR1: To adjust H.HOLD (adjust to center of the adjustable range).
VR2: To adjust V.SIZE (height of the screen).
VR3: To adjust BRT (brightness of the screen).
VR4: To adjust FOCUS (character registration).

7-9 DIP Switches list

① DIP switches on the CPU board

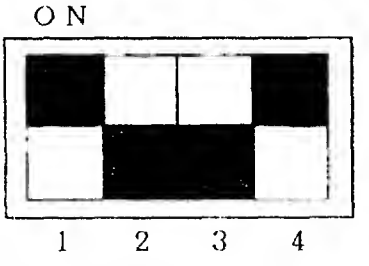
NO.1: RAM backup (normally set to ON).
NO.2: Not used.
NO.3: Enables the execution of the test programs (and EEPROM programming).
NO.4: Specifies whether the analog and digital grounds are to be shared (not required during normal maintenance).

② DIP switches inside the grip (battery chamber)

NO.1: Enables the execution of the test programs (and EEPROM programming). Provides the same functionality as the DIP SW3 on the CPU board. Setting either this switch or DIP SW3 on the CPU board enables the test programs to be executed.
NO.2,3,4: Not used.

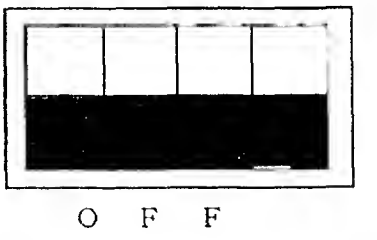
③ Factory settings

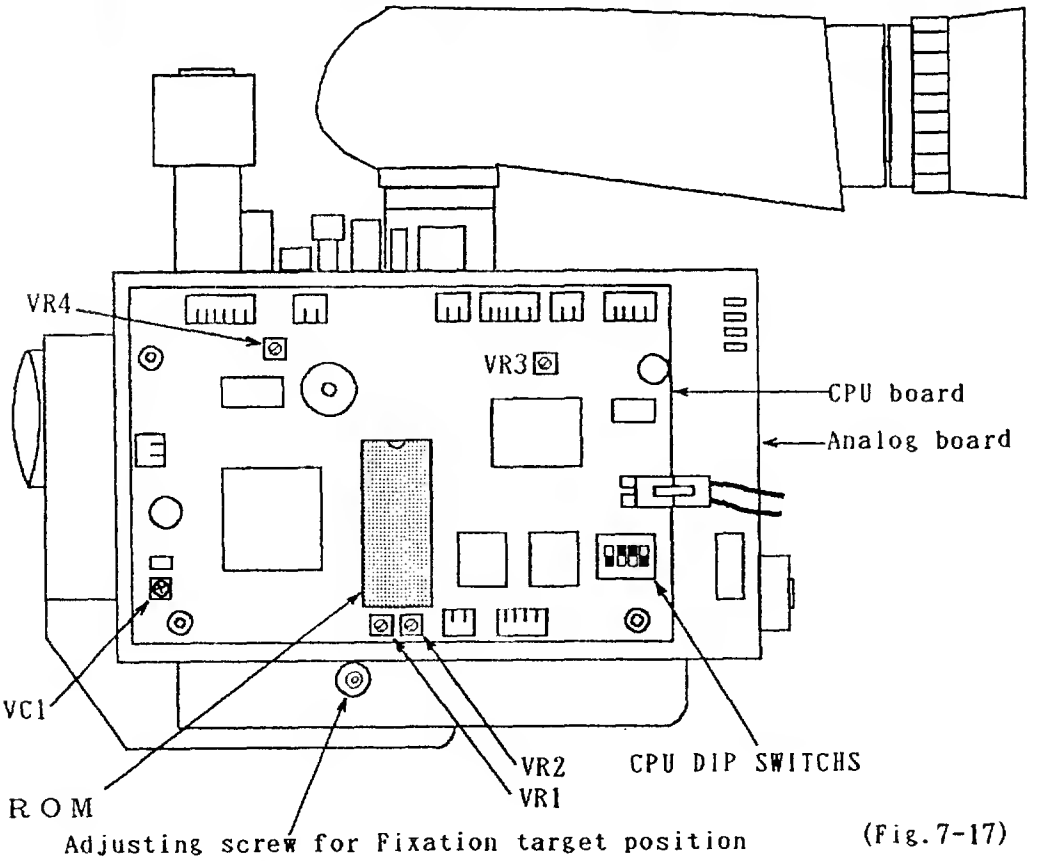
DIP switches on the CPU board



(Fig.7-16)

DIP switches inside the grip





(Fig.7-17)

8 Optical System Adjustments

8-1 Retinomax tools

8-1-1 List of Tools

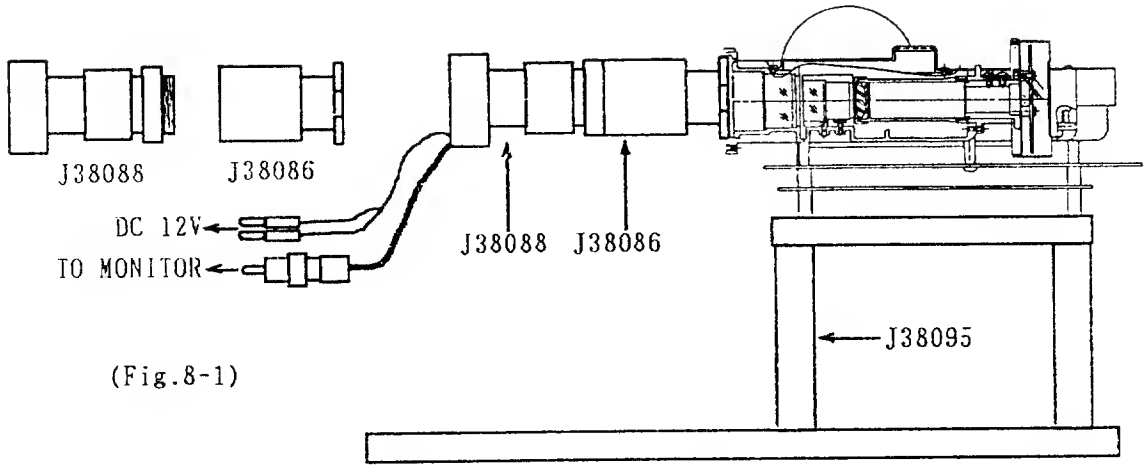
J-35050 Eyepiece with reticle (15X)
J-35057 Eyepiece retaining ring
J-35058 Model eye attaching tool
J-35058A Model eye adapter (Use with J-35058)
J-35066 Blackout curtain

J-38052A High power model eye ±22dpt.
J-38052B High power model eye ±24dpt.
J-38053 Centering telescope
J-38056 Cyl. model eye
J-38057 LED Illuminator (Universal type)
J-38086 Optical adjustment adapter(For base position)
J-38087 Small centering tool
J-38088 TV camera tool
J-38089 Cyl. model eye adapter
J-38090 R/L sensor ref. plate
J-38091 Inspection telescope adapter
J-38092 LED Illuminator(for Retinomax)
J-38093 M.LED positioning tool
J-38094 Photo detector positioning tool
J-38095 Optical adjustment stand
J-38096 R/L sensor adjustment stand
J-38097 Power supply tool

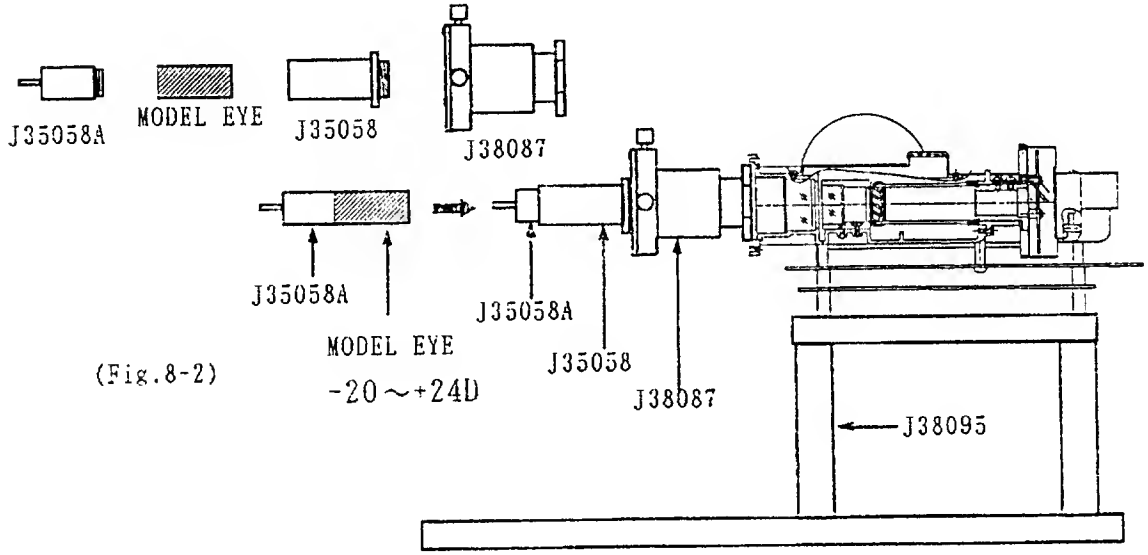
J-39011A Inspecting telescope holder (A)
J-39011B Inspecting telescope holder (B)
J-39014 Inspecting telescope
J-39015 Inspecting lens (-10 dpt.) For fixation target focus
J-39016 Inspecting lens (+10 dpt.) For fixation target focus
J-39029 Model eye for MAIN LED power check
J-39033 Model eye set (-20DP～+20DP)

J-09008 Diopter Inspecting tool

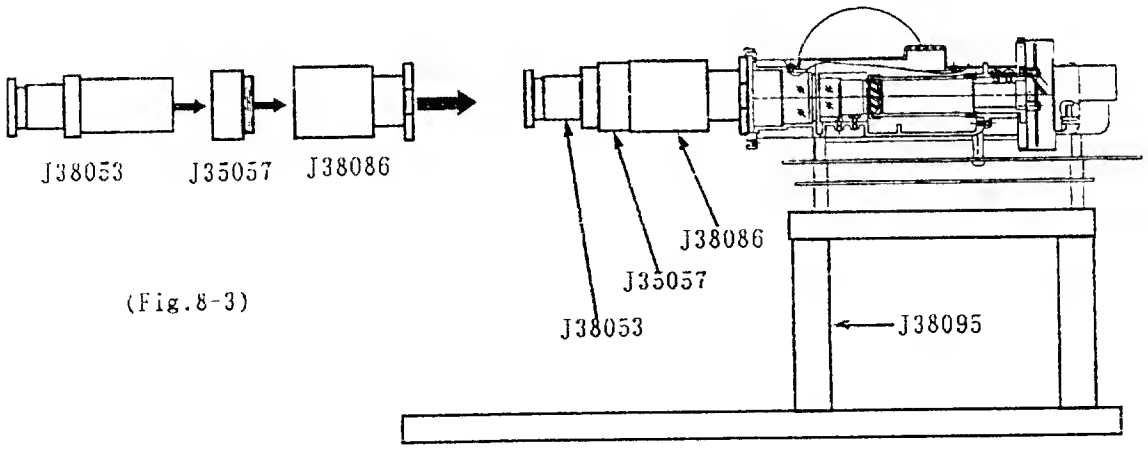
8-1-2 Tool Installation Procedure



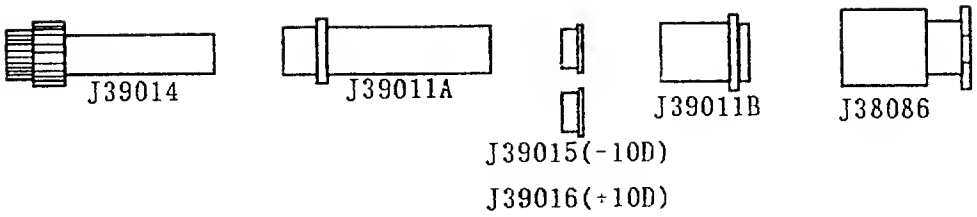
(Fig.8-1)



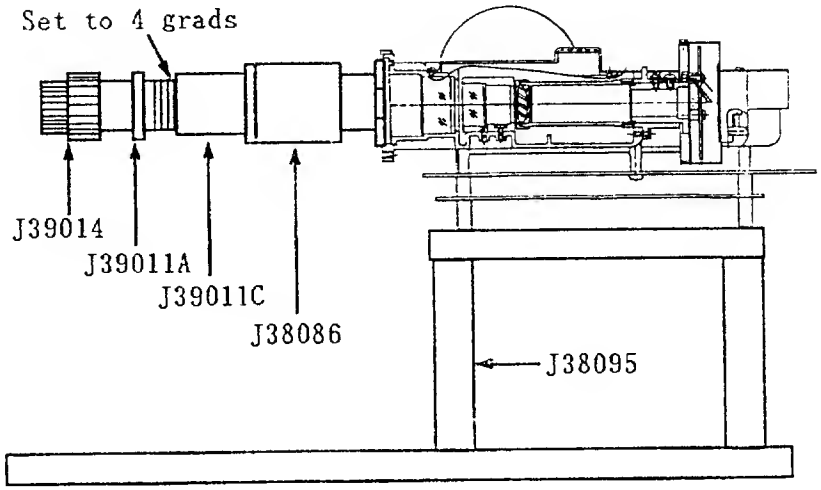
(Fig.8-2)

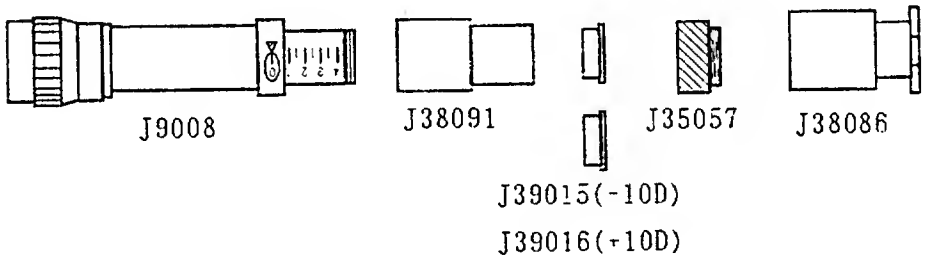


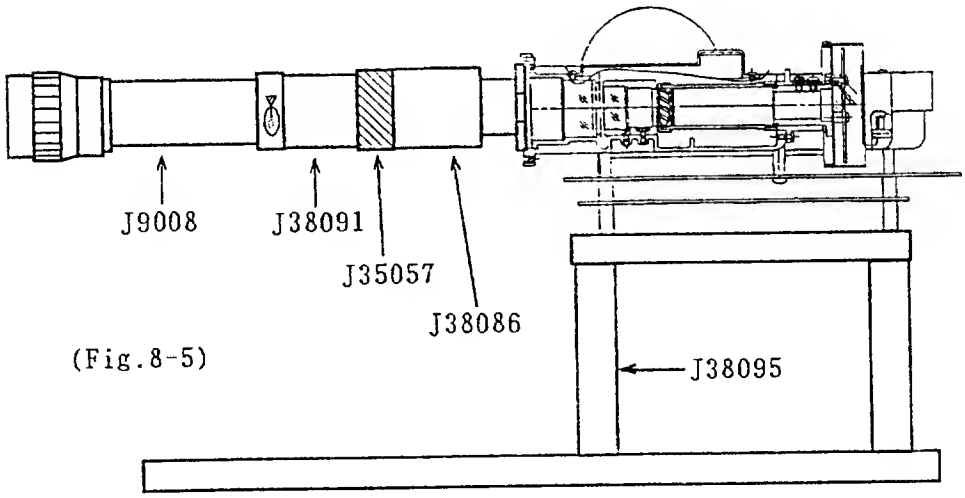
(Fig.8-3)


J39014
J39011A
J39011B
J38086
J39015(-10D)
J39016(+10D)

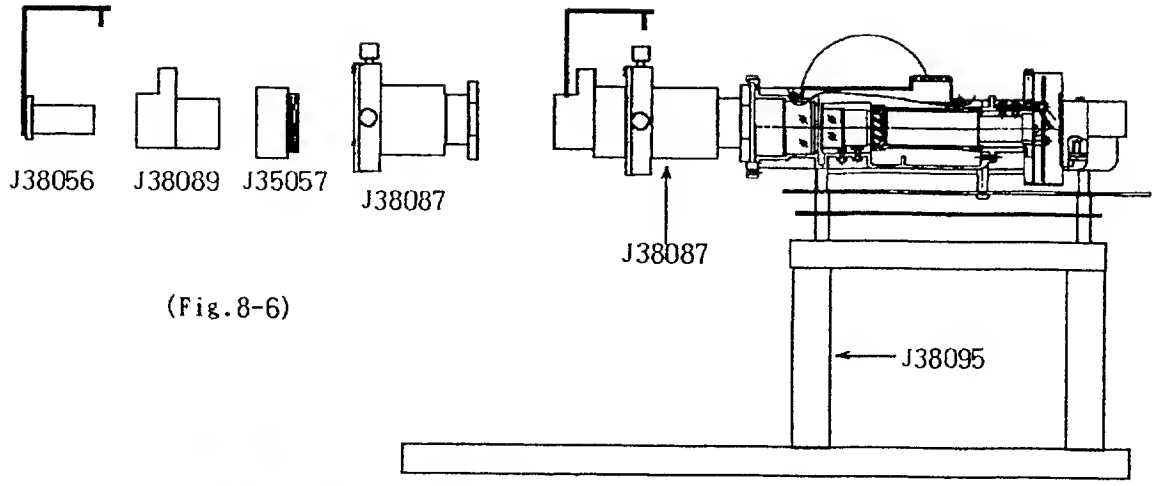
(Fig.8-4)


Set to 4 grads
J39014
J39011A
J39011C
J38086
J38095

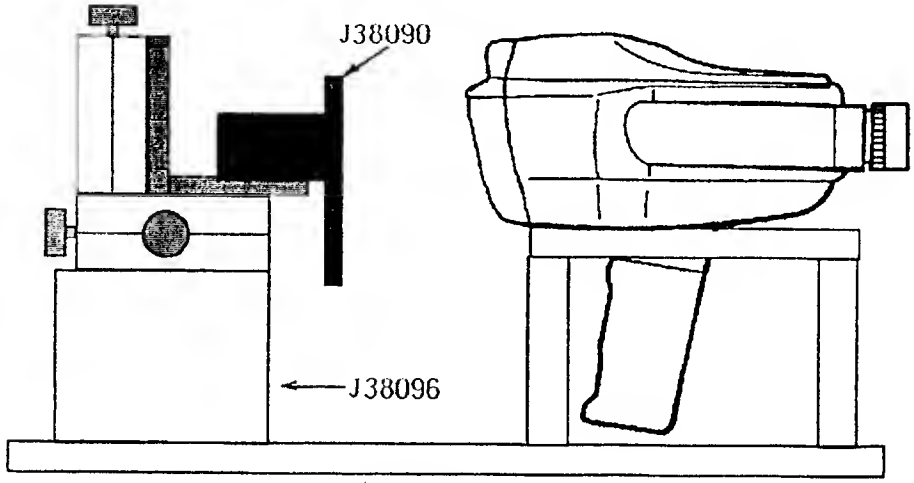

J9008
J38091
J35057
J38086
J39015(-10D)
J39016(+10D)


J9008
J38091
J35057
J38086
J38095

(Fig.8-5)



(Fig.8-6)

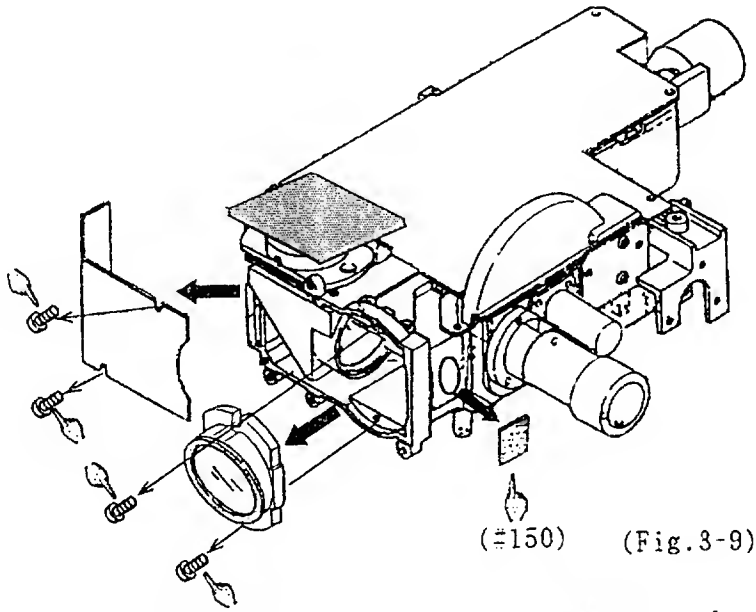


(Fig.8-7)

8－2 Checking and Adjusting the Optical Axis

8-2-1 Checking the Optical Axis
(MAIN LED and photo detector board Position Check)

① Remove the front, top, and botton covers (see Section 6-1, 6-2, and 6-3 for details). Keep the cables connected.
② Mount the Retinomax main body on the optical adjustment stand(J38095).
③ Remove the dust-proof glass assembly(#G1,148,177) and cover(#143).
(See fig. 8-9)

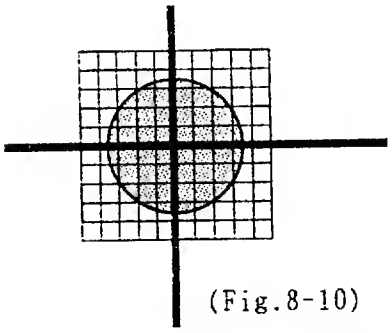


(Fig.3-9)

④ Mount the optical adjustment adapter and TV camera tool on the measurement window. (See fig. 8-1)

⑤ Light the M.LED with J-38097.

⑥ Move the TV camera tool focus ring back and forth, so that the MAIN LED is in focus.



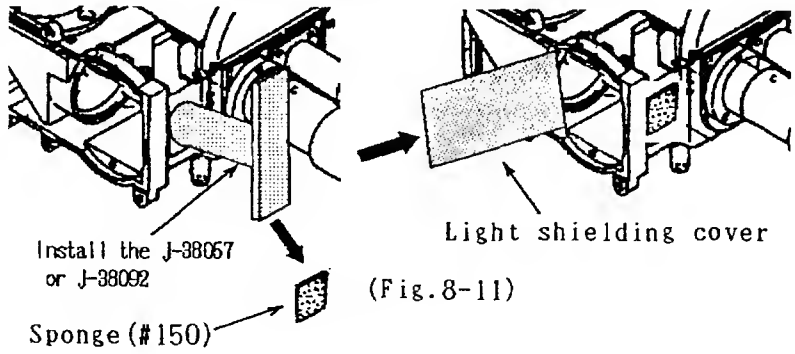
(Fig.8-10)

⑦ Make sure that the center of the reticle on the TV camera tool is aligned with the center of the LED (must be less than 0.5 tick mark).
(See fig. 8-10)

⑧ Turn off the M.LED

⑨ Remove the sponge(#150) located on the side of the measurement window.
(See fig. 8-9)

⑩ Direct the light of an illuminating LED attachment(J38057) or (J38092) into the photo detector.
Insert a light-shielding cover to screen unnecessary light off the light channel of the fixation target. (See Fig.8-11)



(Fig.8-11)

⑪ Make sure that the center of the reticle on the TV camera tool is aligned with the center of the photo detector(must be less than 0.5 tick mark). (See fig. 7-11)

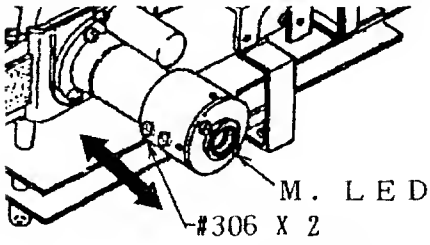
⑫ If the offset exceeds the specification, proceed to Subsection 8-2-3, Adjusting the Optical System Position, and readjust the position of the optical system.

8-2-2 Adjusting the Focus of the Optical System
(Focusing the MAIN LED and photo detector)

① Mount the main body on the optical adjustment stand(J38095) while referring to steps ① to ④ in Subsection 8-2-1.
② Install the optical adjustment adapter(J-38086) and TV camera tool (J-38088) on the measurement window. (See fig. 8-1)

Adjusting the focus of the MAIN LED:

③ Turn on the M.LED with J-38097.
④ Move the TV camera tool focus ring back and forth, so that the reticle of the TV camera tool into focus.



(Fig.8-12)

⑤ Loosen the set screws (#306) on the MAIN LED and slide the LED back and forth, so that the image of MAIN LED into focus.
Tighten the set screws

:Check the M.LED position, if it is necessary to adjust the M.LED position, go to 8-2-3.

⑥ Go to step (⑨) if focal adjustment on the photo detector board is required. Otherwise, proceed to step (⑦) .

⑦ Attach the photo detector cover.

:Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

:Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

:Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

:Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

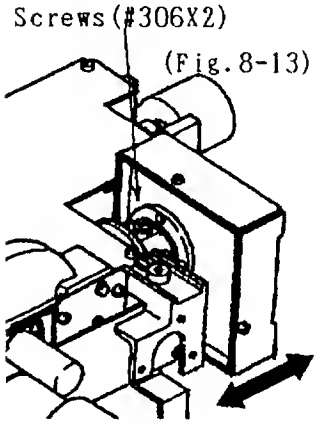
⑧ Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

Adjusting the focus of the photo detector:

⑨ Turn off the Retinomax.
⑩ Remove the sponge(#150) located on the side of the measurement window.
⑪ Install the optical adjustment adapter(J-38086) and TV camera tool (J-38088) on the measurement window. (See fig. 8-1)

⑫ Direct the light of an illuminating LED attachment(J38057) or (J38092) into the photo detector.
⑬ Insert a light-shielding cover to screen unnecessary light off the light channel of the fixation target. (See Fig.7-8)
⑭ Bring the reticle of the TV camera tool(J38088) into focus.

Screws(#306X2)
(Fig.8-13)



⑮ Loosen the screw (#306) and slide back and forth the photo detector assembly, so that the board is in focus (See Fig.8-13).

:Check the photo detector position, if it is necessary to adjust the photo detector position, go to 8-2-3.

⑯:Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

:Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

:Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

:Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

⑰ Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

8-2-3 Adjusting the Optical System Position
(Adjusting the Position of the MAIN LED and photo detector)

Adjusting the position of the MAIN LED:

① Performs steps (①) to (⑦) in Subsection 8-2-1.

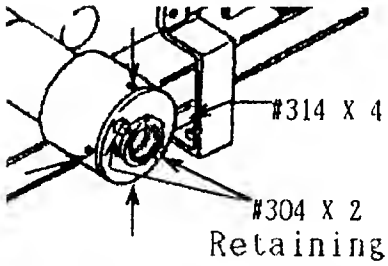
②:Make sure that the center of the reticle on the TV tool is aligned with the center of the LED (must be less than 0.5 tick mark).
(See Fig.8-10)

:Make sure that the center of the reticle on the TV tool is aligned with the center of the photo detector(must be less than 0.5 tick mark).
(See Fig.7-11)

Go to step (③) if the center of the M.LED is not aligned.
Go to step (⑦) if the center of the photo detector is not aligned.
Go to step (③) if the both of the centers are not aligned.

③ Loosen two screws(#304 X 2pcs.) (See Fig. 8-14)

④ Adjust the M.LED position with four hexagon head screws(#314). Move the M.LED base horizontally and vertically so that the center of the MAIN LED falls at the center of the TV camera tool.
(See Fig. 8-14)



(Fig.8-14)

⑤ When the adjustment is completed, tighten the two MAIN LED retaining screws. (#304 X 2pcs.)

⑥ Tighten the four hexagon head screws.
(See Fig. 8-14)

Go to step (⑦) if it is necessary to adjust the position of the photo detector. Otherwise, proceed to step (⑮) .

Adjusting the position of the photo detector:

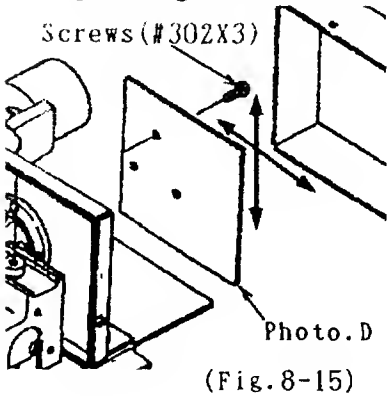
⑦ Performs steps ① to ④ in Subsection 8-2-1.

⑧ Remove the sponge(#150) located on the side of the measurement window.

⑨ Direct the light of an illuminating LED attachment(J38057) or (J38092) into the photo detector.

⑩ Insert a light-shielding cover to screen unnecessary light off the light channel of the fixation target. (See Fig.8-11)

⑪ Bring the reticle of the TV camera tool(J38088) into focus.



(Fig.8-15)

⑫ Remove the cover from the photo detector board. Loosen the board mounting screws(#302) and adjust the position of the photo detector board so that the center of the reticle of the TV camera tool is aligned with the center of the photo detector.
(See Fig.7-11, 8-15)

⑬ Place the photo detector cover if the adjustment is completed.

⑭ :Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

:Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

:Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

:Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

⑮ Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

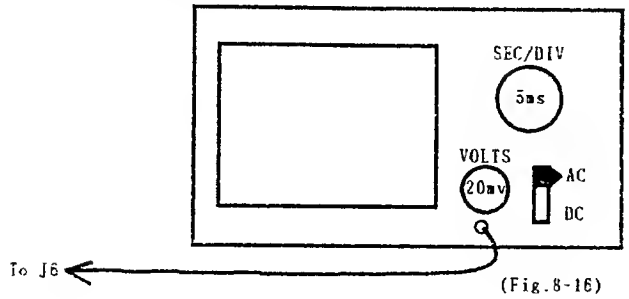
8 – 3 Adjusting and Checking the Chopper Unit

8-3-1 Checking the Chopper Sensor Unit

① Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected.

② Mount the Retinomax main body on the optical adjustment stand(J38095) or a stable bench.

③ Prepare a oscilloscope.



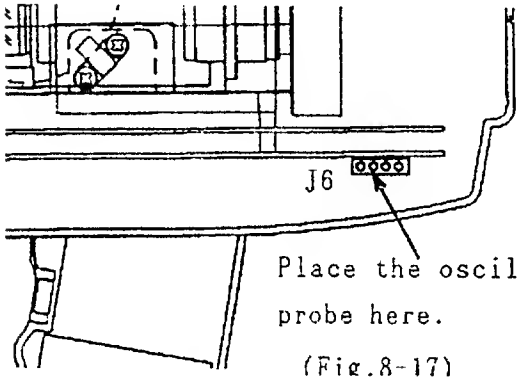
(Fig.8-16)

④ Set up the oscilloscope as follows: (See fig.8-16)

Oscilloscope settings:

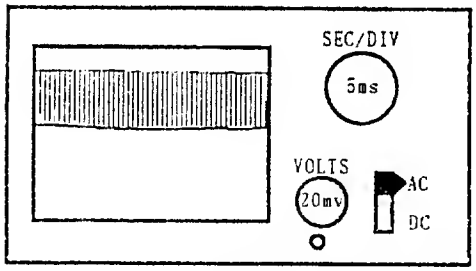
CH1: 20 mv(200mv) (AC mode).
Connect to pin 3 on J6 on the CPU board.
GND: TP5 on the analog board.

Horizontal axis: 5 ms
Probe: 10 to 1



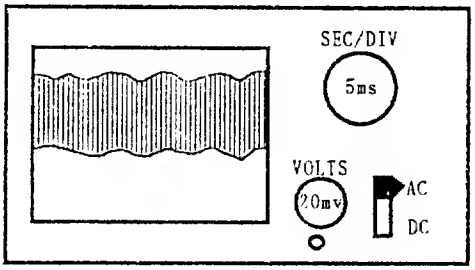
(Fig.8-17)

⑤ Place the probe at pin 3 of J6 (keep the connectors on the board during the measurement). (See fig.8-17)



Proper sensor position

(Fig.8-18)



Improper sensor position

(Fig.8-19)

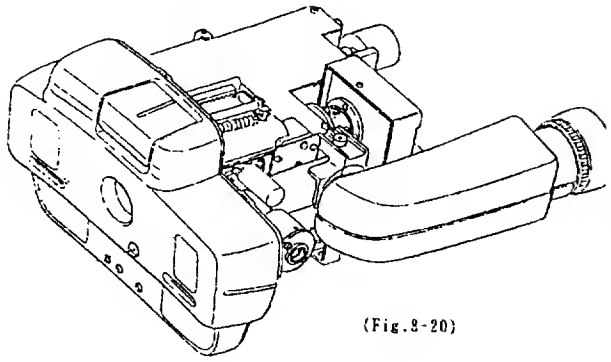
⑥ Execute TEST-03 to drive the chopper.

⑦ Check the waveform on the oscilloscope while referring to Fig. 8-18.

A waveform similar to that shown in Fig. 8-19 indicates that the chopper sensor is located at an inappropriate position.

:See Subsection 8-3-3 for the procedure to adjust the chopper sensor position.

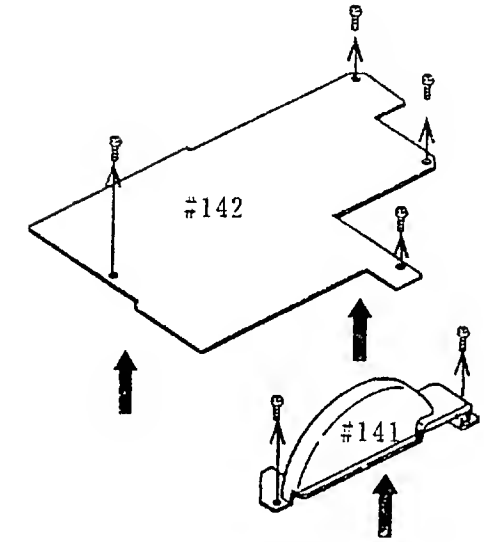
8-3-2 Replacing the Chopper Motor and Chopper



(Fig.8-20)

① Remove the top and bottom covers while referring to Sections 6-1 and 6-2.

(See fig. 8-20)

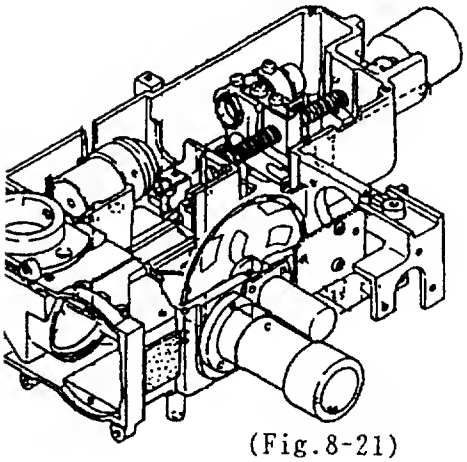


② Remove the internal dust-proof cover(#142) and chopper cover(#141).

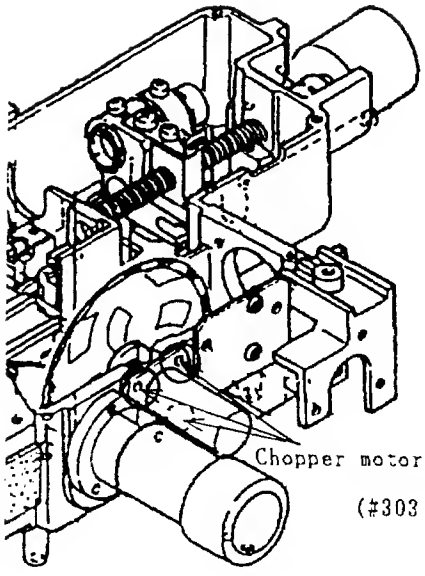
(See fig. 8-21)

Caution:

The chopper is made up of a very thin metal plate and highly flexible. Take extreme care when removing the chopper cover.



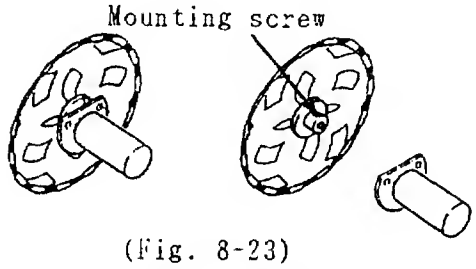
(Fig.8-21)



(Fig. 8-22)

③ Remove the chopper motor mounting screws and remove the motor and chopper assembly.

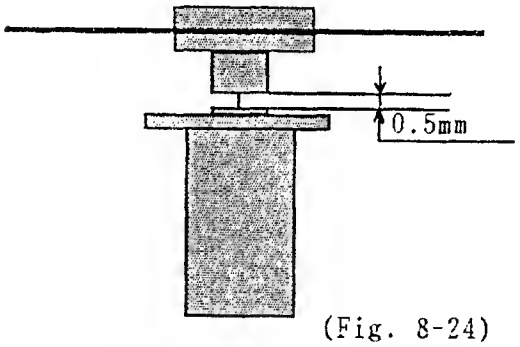
(See fig. 8-22)



(Fig. 8-23)

④ Loosen the chopper mounting screw and remove the motor.

(See fig. 8-23)



(Fig. 8-24)

⑤ Replace the chopper or motor with the new one and reassemble. Make sure that the there is a clearance of 0.5 mm between the motor and chopper (See Fig. 8-24).

⑥ Install the internal cover(#142) and chopper cover(#141) in the reverse order of disassembly.

⑦ While referring to Subsection 8-3-1, make sure that the chopper sensor is positioned properly. If not, adjust the position of the chopper sensor according to the instructions given in Subsection 8-3-3.

⑧ :Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

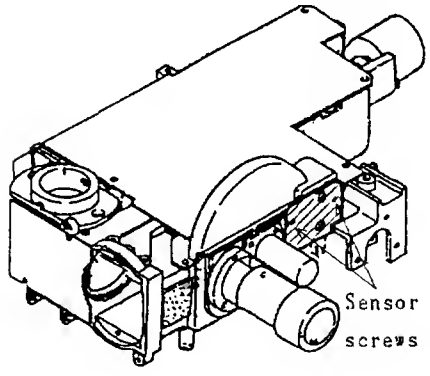
:Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

:Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

:Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

⑨ Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

8-3-3 Adjusting the Position of the Chopper Sensor



(Fig. 8-25)

① While referring to Subsection 8-3-1, check the position of the chopper sensor.

② If the sensor is positioned improperly, loosen the screws on the chopper sensor mounting plate. (See Fig. 8-25)

Readjust the position of the chopper sensor mounting plate so that a valid waveform is observed (See Fig. 8-18,-19).

③ :Readjust the camera position(alignment) while referring to Subsection "8-6-3 Adjusting the camera position".

:Readjust the TOT value while referring to Subsection "8-6-4 Adjusting the TOT".

:Reenter the compensation values while referring to Subsection 8-7-2, Spherical and Cylindrical Power Calibration.

:Reenter the compensation value while referring to Subsection 8-7-3, Cylindrical Axis Calibration.

④ Perform the quick inspection explained in Section 3-1 before completing the replacement procedure.

8 - 4 Adjusting and Checking the View Finder

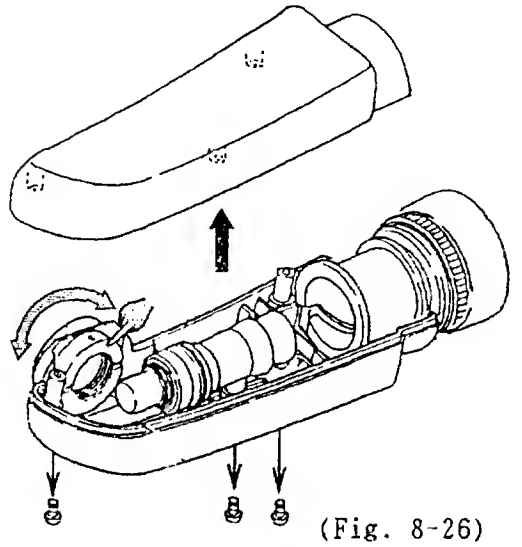
8-4-1 Checking the View Finder

① Turn on the Retinomax and observe from the eyepiece assembly to check for any dust inside the finder.
→Dust on the view finder, go to Subsection 8-4-3.

② Check the characters displayed in the finder. (Position, Contrast and Outline)
→If it is necessary to adjust it, go to 8-4-4,-5.

③ Turn the eyepiece power adjusting ring and check for smooth rotation.
→If it is not smooth, go to 8-4-3.

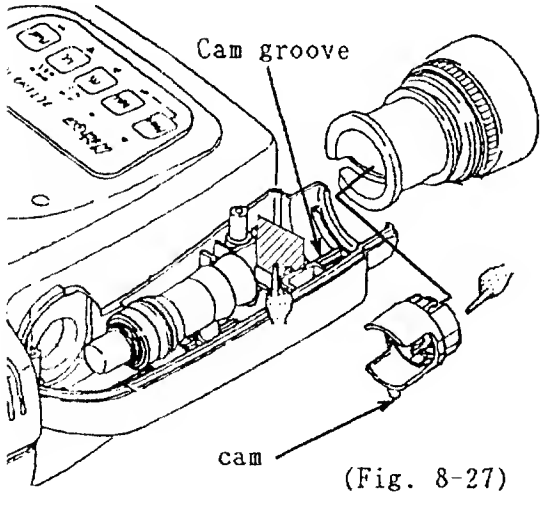
④ Check the rotation torque.
→If it is necessary to adjust it, go to 8-4-2.



(Fig. 8-26)

8-4-2 Adjusting the View Finder Torque

① Remove the three screws.
(See fig. 8-26)
② Remove the top cover from the view finder.
③ Loosen the set screw on the torque adjusting ring.
④ Turn the torque adjusting ring to obtain the desired torque.
⑤ Tighten the set screw on the torque adjusting ring and place the top cover.



(Fig. 8-27)

8-4-3 Disassembling and Cleaning the Eyepiece Assembly

① Remove the three screws.
(See fig. 8-26)
② Remove the top cover from the view finder.
③ Remove the eyepiece assembly.
④ Disassemble the eyepiece assembly and check it for smooth operation.
If the eyepiece operation is not smooth, add lubricant (G7920) or check the cam groove for flaws.
⑤ Blow off any dust off the optical system.

Caution:
Do not use cleaner when wiping off the dust. Because the dust-proof glass as it is made of plastic.

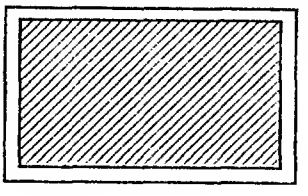
⑥ Align the cam system and assemble the eyepiece assembly. Turn the eyepiece power adjusting ring and check for eyepiece cam system. (See fig. 8-27)

8-4-4 Adjusting the Character Position

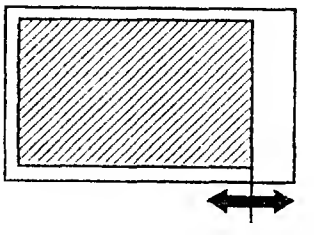
Adjust the position and layout of the characters displayed on the view finder screen.

①: To vertically and horizontally align the characters, execute TEST-09 and adjust the H and V compensation values (see the subsection on TEST-09 for details).

②: To adjust the horizontal size the characters, remove the bottom cover (see Section 6-2) and adjust the VC1 on the CPU board.

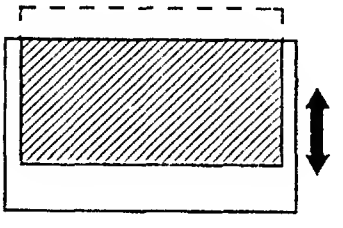


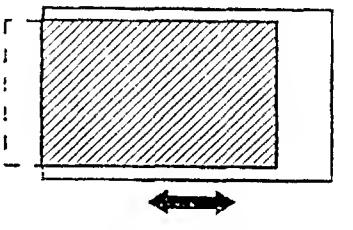
(Fig. 8-28)



Well balanced characters

Adjust the VC1 on the CPU board.





Execute TEST-09 to adjust the V value

Execute TEST-09 to adjust the H value

8-4-5 Adjusting the Contrast and Outline

Adjust the contrast and outline of the view finder screen whenever you replaced the view finder or the characters on the screen appear to be distorted.

① Remove the bottom cover (see Section 6-2 for details). Keep the cables connected to the CPU board.

② Adjust the VR1 and VR2 on the CPU board.

VR1: Adjusts the registration of the characters on the view finder screen.

VR2: Adjusts the contrast of the view finder screen.

Turn each VR knob to the center of the adjustable range before starting the adjustment to shorten the adjustment time.

③ There is no specific standard for these characteristics. Adjust the variable resistor so that an easy-to-see, natural textual and eye images can be obtained.

8－5 Adjusting the Fixation Target System

8-5-1 checking the Fixation Target System

★ Preparatory procedure

①: Remove the front cover (see Section 6-3 for details). Keep the cables connected to the board.

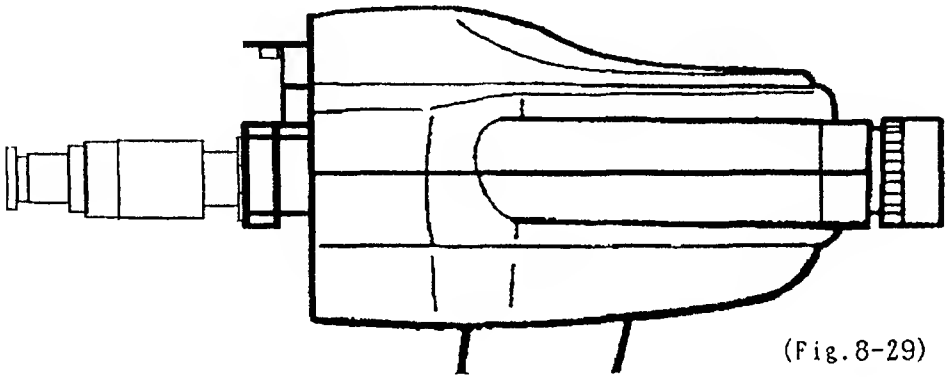
②: Remove the dust-proof glass assembly(G1,148,177) and cover(#143). (See fig. 8-3)

③: Mount the adapter tool (J38086) to the measuring window

★ Checking the position and tilt of the fixation target (picture target)

①: Perform preparatory steps (①) to (③).

②: Install a centering telescope(J38053) and eyepiece retaining ring (J-35057). (See fig. 8-3, 8-29)



(Fig.8-29)

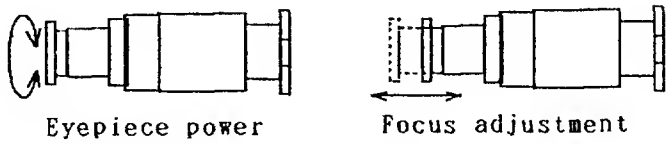
③ Execute TEST-0A (for detailed instructions, see Section 5-3,).

```
0A:FOG  OFST
  EXIT
    STEP:0025
>     0DP
    10DP
  -10DP
    SET


    POS:⑥

    P:START   -:PRINT
```

(FIG.8-30)

④ Execute the test with the cursor positioned on "0DP" (see Fig. 8-30).

⑤ Adjust the eyepiece power of centering telescope tool and move the eyepiece back and forth, so that the picture target is in focus. (See Fig. 8-31)

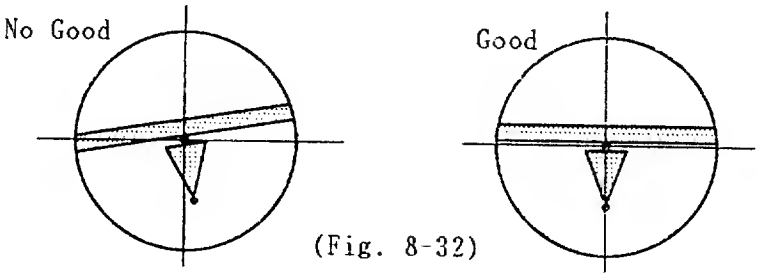


Eyepiece power adjustment

Focus adjustment

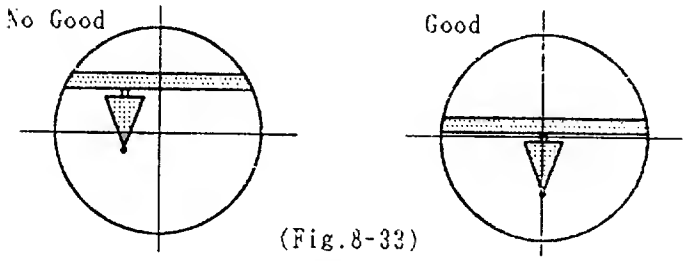
(Fig. 8-31)

⑥ Check for any outstanding tilt. If the tilt is excessive, go to Subsection 8-5-3, Adjusting the Fixation Target Tilt.
(see Fig. 8-31)

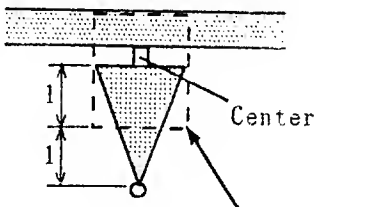


(Fig. 8-32)

⑦ Check the position of the fixation target. See Figure 8-33,-34 for the reference position. If it is necessary to adjust the target position, go to 8-5-4.



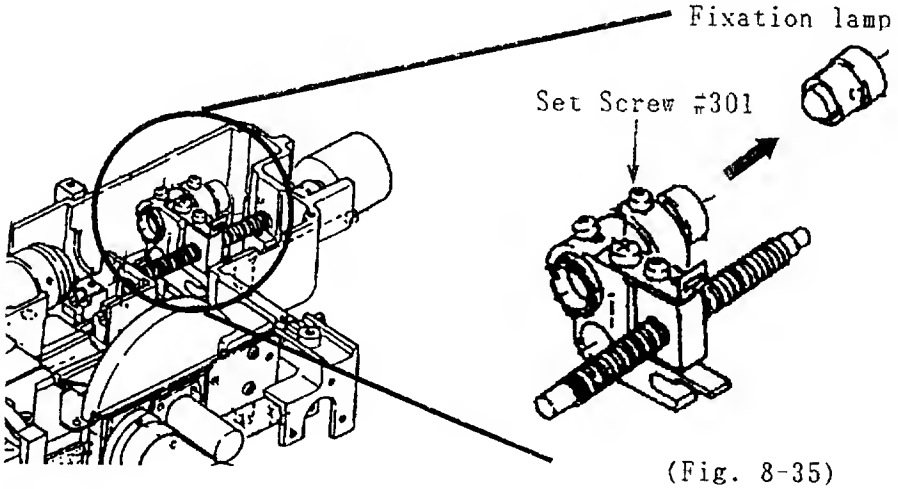
(Fig.8-33)



(Fig.8-34)

★ Checking the focus of the fixation target (picture target)
① Performs steps ① to ③ in Subsection 8-5-1 Preparatory procedure.
② Check the focus of the fixation target while referring to Subsection 8-5-5.

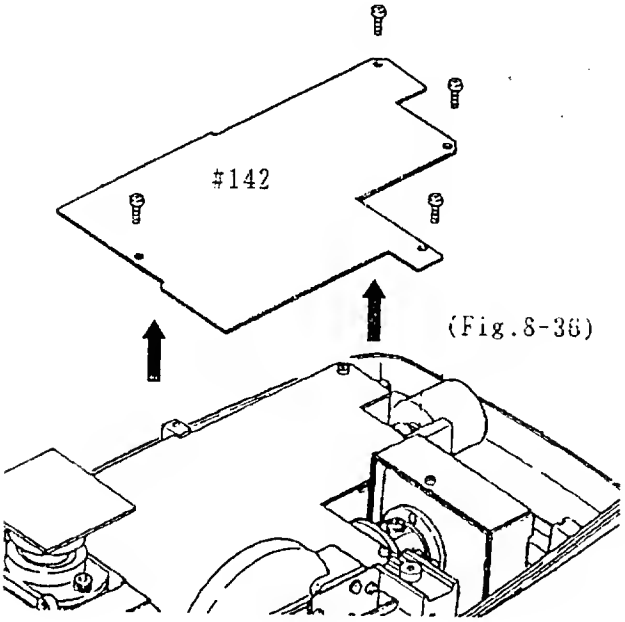
8-5-2 Replacing the Fixation Target Lamp
① Remove the top and bottom covers while referring to Sections 6-1 and 6-2.
② Remove the dust-proof cover(#142). (See fig. 8-36)
③ Remove the screw (#301) for the fixation target lamp. (See fig. 8-35)



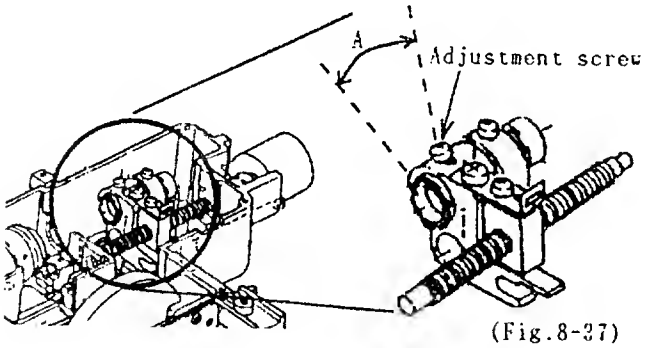
(Fig. 8-35)

④ Replace the fixation target lamp with the new one.(#615,131)
⑤ Reassemble the fixation target in the reverse order of disassembly.

8-5-3 Adjusting the Fixation Target Tilt
① Perform steps (①) to (⑥) for checking the fixation target position.
② Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected to the board.
③ Remove four cover screws and remove the internal dust-proof cover(#142). (See fig. 8-36)



(Fig.8-36)



(Fig.8-37)

④ Loosen screw in Fig. 8-37 slightly and move the screw left and right as shown in (A) to adjust the tilt of the fixation target.

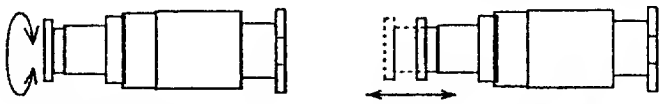
⑤ Tighten the screw. Proceed to the positional adjustment procedure when the tilt adjustment is completed.

8-5-4 Adjusting the Fixation Target Position
① Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected to the board.
② Mount the main body on the optical adjustment stand(J38095) Perform steps (①) to (③) for checking the fixation target position. Remove the dust-proof glass assembly(G1,148,177) and cover(#143). (See fig. 8-9)

③ Install a centering telescope(J38053), eyepiece retaining ring(J-35057) and adapter(J38091). (See fig. 8-3)
④ Execute TEST-0A (for detailed instructions, see Section 5-3).

⑤ Execute the test with the cursor positioned on "ODP" (see fig. 8-30).

⑥ Adjust the eyepiece power of centering telescope tool and move the eyepiece back and forth, so that the picture target is in focus.
(See fig. 8-38)

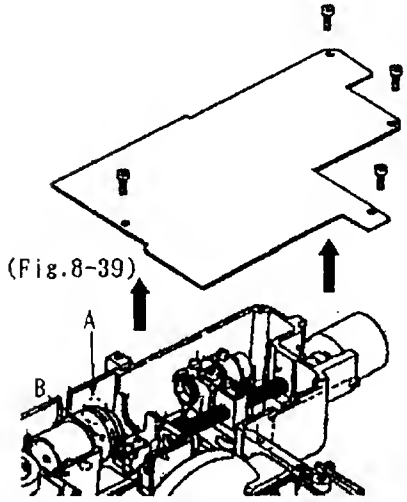


(Fig. 8-38)

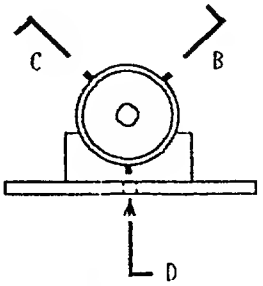
⑦ Remove four cover screws and remove the internal dust-proof cover(#142).
(See Fig. 8-39)

⑧ Apply a small mount of alcohol to portion (A) in Fig.8-39 to dissolve the screw lock material.

⑨ Adjust the three hexagon head screws (B,C,D) to adjust the position of the fixation target (picture target). Refer to Fig.8-43 for the limit of tolerances.

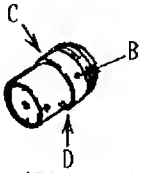


(Fig.8-39)

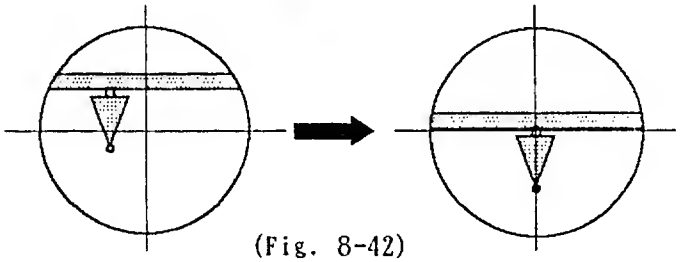


Insert the allen wrench from the bottom side.

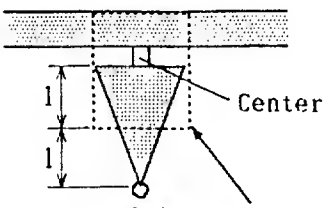
(Fig. 8-40)



(Fig. 8-41)



(Fig. 8-42)



(Fig. 8-43)

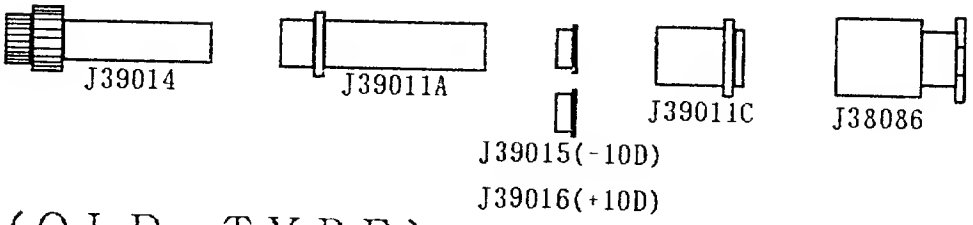
⑩: When the adjustment is completed, reassemble the unit in the reverse order of disassembly.

8-5-5 Adjusting the Fixation target Focus

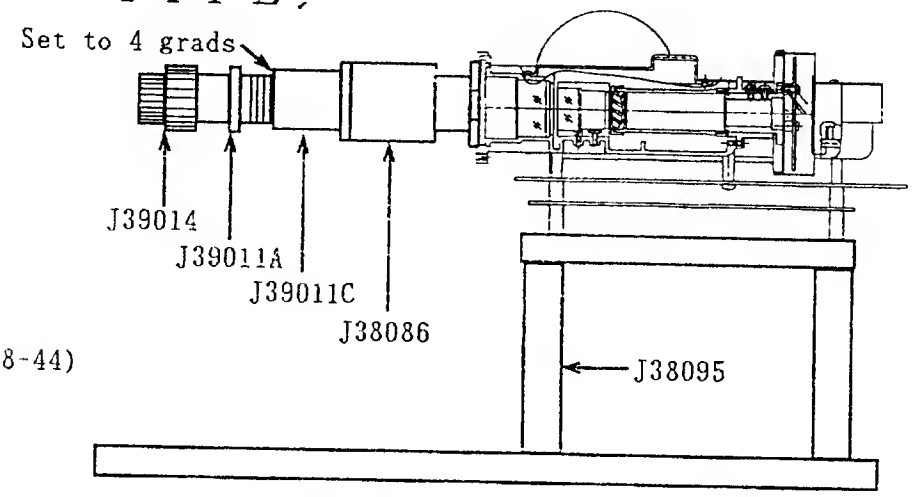
① Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected to the board.

② Mount the main body on the optical adjustment stand(J38095) Perform steps (①) to (③) for checking the fixation target position. Remove the dust-proof glass assembly(G1,148,177) and cover(#143).
(See fig. 8-9)

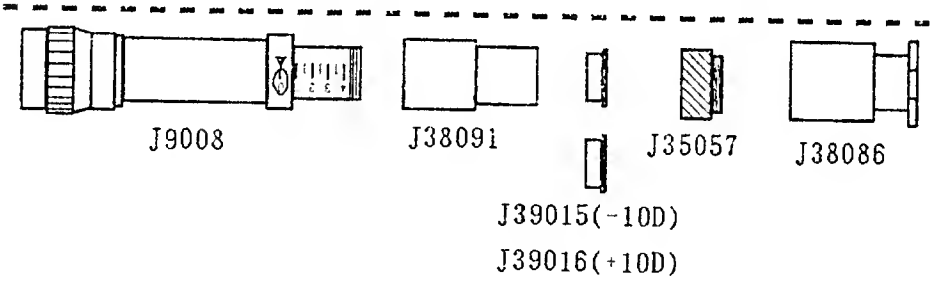
③ Install the Inspecting telescope tools (old type or new type).
(See fig. 8-44,-45)



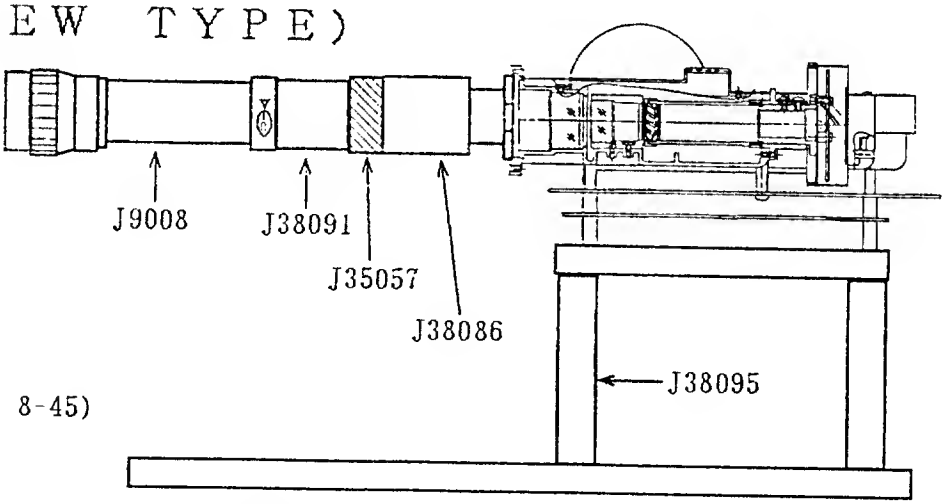
(OLD TYPE)



(Fig. 8-44)



(NEW TYPE)



(Fig. 8-45)

Both a new type and an old type tools can be used.

④ Execute TEST-0A (for detailed instructions, see Section 5-3).
⑤ Execute the test with the cursor positioned on "0DP" (see Fig. 8-46).
(POS: 000) Fixation target is set at the position of "0DP".
Write down the value displayed in ⑧ in the note.

```
0 A : F O G   0 F S T
> E X I T
①  S T E P : 0 0 2 5  ⑦
②    0 D P    ⑧
③  1 0 D P    ⑨
④- 1 0 D P    ⑩
⑤  S E T


    P O S : ⑥

    P : S T A R T    - : P R I N T
```

(FIG.8-46)

⑥ Check the focus of fixation target with out additional inspecting lens (J39015,J39016)
⑦ While observing through the diopter Inspecting tool(J9008 or J39014), press either the READY KEY or the PRINT KEY and find the most optimum position where the fixation target is visible.
⑧ After adjustment, read the value in ⑧ and compare present values with the previous value. whether there is difference in the value.
The limit of tolerances is ±0.5D or less.
If it is necessary to adjust the focus, go to "Adjustment procedure" page 74.

⑨ Execute the test with the cursor positioned on "10DP" (POS: 1000)
Write down the value displayed in ⑨ in the note. (See Fig. 8-46).
Fixation target is set at the position of "10DP".
⑩ Mount a -10D additional inspecting lens (J39015) on the adapter(J38091 or J39011A)
While observing through the diopter Inspecting tool(J9008 or J39014), press either the READY KEY or the PRINT KEY and find the most optimum position where the fixation target is visible.
⑪ After adjustment, read the value in ⑨ and compare present values with the previous value. whether there is difference in the value.
The limit of tolerances is ±0.5D or less.
If it is necessary to adjust the focus, go to "Adjustment procedure" page 74.

⑫ Execute the test with the cursor positioned on "-10DP" (POS:-1000)
Write down the value displayed in ⑩ in the note. (See Fig. 8-46).
Fixation target is set at the position of "-10DP".
⑬ Mount a +10D additional inspecting lens (J39016) on the adapter(J38091 or J39011A)
While observing through the diopter Inspecting tool(J9008 or J39014), press either the READY KEY or the PRINT KEY and find the most optimum position where the fixation target is visible.
⑭ After adjustment, read the value in ⑩ and compare present values with the previous value. whether there is difference in the value.
The limit of tolerances is ±0.5D or less.
If it is necessary to adjust the focus, go to "Adjustment procedure" page 74.

```
0A:FOG  OFST
>EXIT
①  STEP:0025  ⑦
②    0DP     ⑧
③  10DP       ⑨
④-10DP        ⑩
⑤  SET


    POS:⑥

    P:START   -:PRINT
```

(FIG.8-47)

Adjustment procedure

① Execute TEST-0A and execute the test with the cursor positioned on ②. POS. 000

② While observing through the dioptic inspecting tool, press either the "READY KEY" or the "PRINT KEY" and find the most optimum position where the fixation target is visible.

③ Execute the test with the cursor positioned on ③. POS: 10.00
Mount a -10D additional inspecting lens (J39015) on the adapter(J38091 or J39011A). While observing through the Inspecting telescope(J9008 or J39014) press either the "READY KEY" or the "PRINT" and find the most optimum position where the fixation target is visible.

④ Execute the test with the cursor positioned on ④. POS:-10.00
Mount a +10D additional inspecting lens (J39016) on the adapter(J38091 or J39011A). While observing through the Inspecting telescope(J9008 or J39014) press either the "READY KEY" or the "PRINT" and find the most optimum position where the fixation target is visible.

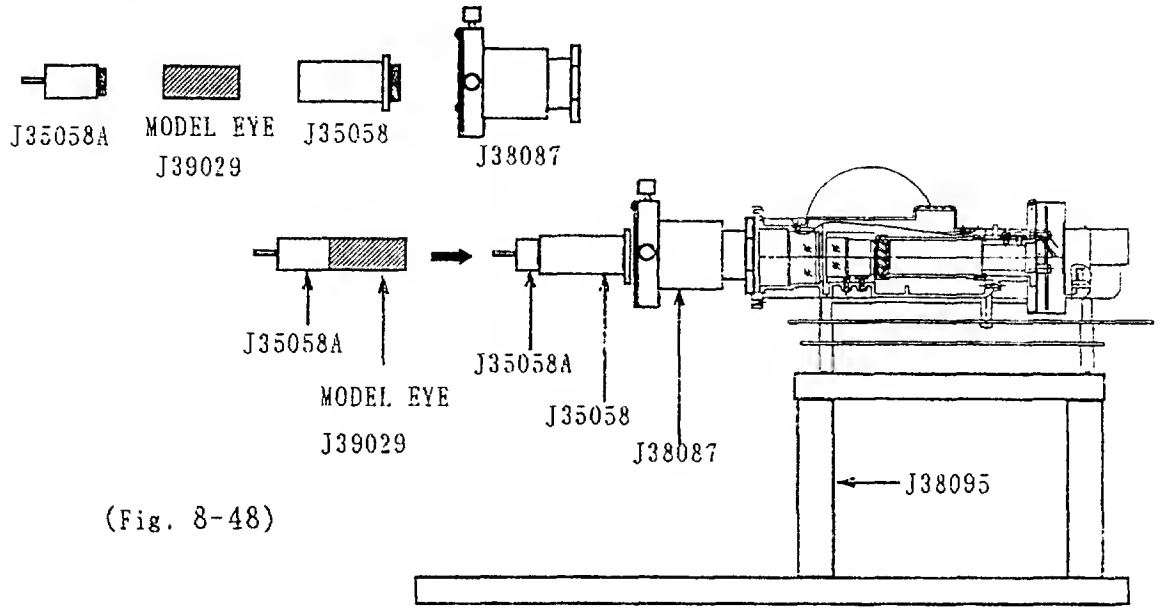
⑤ Execute the test with the cursor positioned on ⑤ and save the compensation values. A short beep will be heard when the compensation values are saved.

8－6 Adjusting the TV Camera

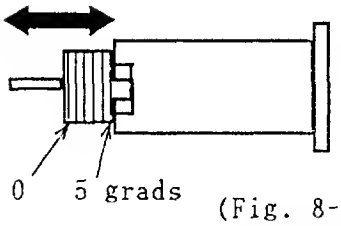
8-6-1 Checking the TV Camera (Checking the Alignment and TOT)

Alignment

①: Remove the front cover (see Section 6-3 for details). Keep the cables connected to the board.
②: Remove the dust-proof glass assembly(G1,148,177) and cover(#143)
③: Install the small centering tool(J38087) in the measurement window (See Figure 8-48).
④: Install the model eye (J39029) and model eye mounting attachment (J35058 + J38058A) on the small centering tool(J38087).



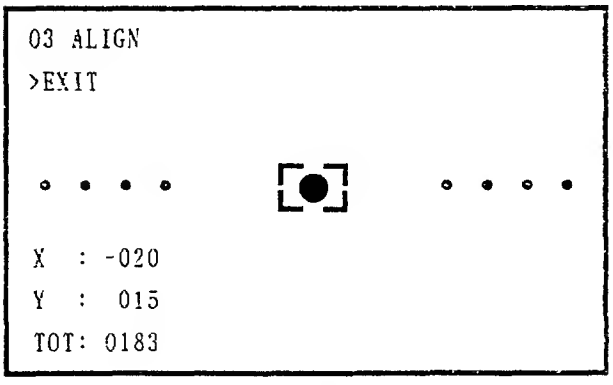
(Fig. 8-48)



(Fig. 8-49)

⑤ Execute TEST-03. Move the model eye back and forth so that so that the reflected ray from the LED is in focus. (See fig. 8-49)

⑥ Adjust the small centering tool(J38087) to align the LED's reflected ray point with the center of the target.



⑦ Read the X and Y values when the LED's reflected ray point is at the center of the target. The X and Y values must fall within the specifications (X ±65, Y ±35). If the X and Y values do not fall within their specification, go to Subsection 8-6-3, Adjusting the TV Camera Position.

(Fig. 8-50)

Shows in the limit of tolerances shown in Fig. 8-50.

TOT check

⑧ Adjust the small centering tool(J38087) so that the X and Y values fall within X ±3 and Y ±3, respectively.

⑨ Make sure that the TOT value is 190 ±30. If the TOT value does not fall within the specification, go to Subsection 8-6-4, Adjusting the TOT Value.

8-6-2 Adjusting the Focus and Tilt of the TV Camera

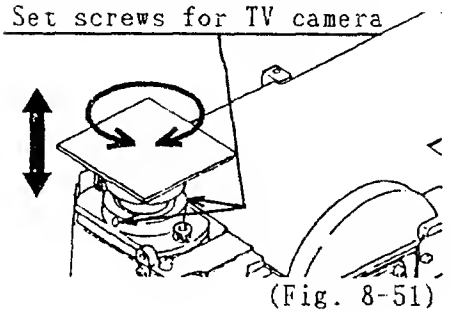
① Perform steps (①) to (④) for 8-6-1 checking the TV camera.

② Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected to the board.

③ Mount the TV camera on the optical adjustment stand(J38095)

④ Align the fifth line of the model eye adapter with the edge of the model eye attaching tool(J35058). (See fig. 8-49)

⑤ Execute TEST-03.



(Fig. 8-51)

⑥ Loosen hexagon head screws in Figure 8-51.

⑦ Move the TV board up and down for focus adjustment and rotate the board to adjust the tilt of the TV camera. (See fig. 8-51)

⑧ To make sure that the TV camera is in focus, move back and forth the model eye mounting attachment until the LED's reflected ray point is in focus. At this moment, check that the model eye mounting attachment is set to tick mark 5. If not, move the TV camera up or down again.

⑨ After the adjustment is completed, tighten the set screws. Go to 8-6-3.

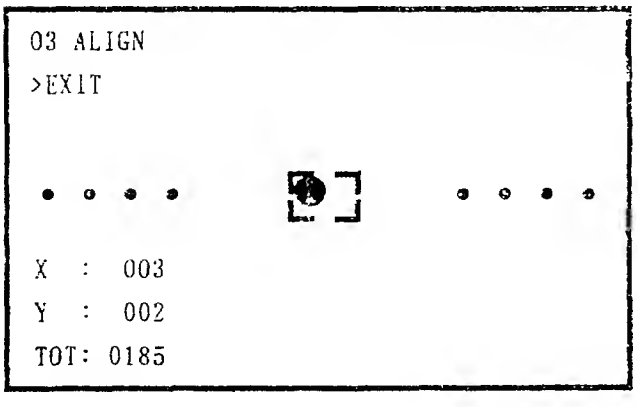
8-6-3 Adjusting the TV Camera Position (Alignment)

① Perform steps (①) to (④) for 8-6-1 checking the TV camera.

② Remove the top and bottom covers (see Sections 6-1 and 6-2 for details). Keep the cables connected to the board.

③ Mount the TV camera on the optical adjustment stand(J38095)

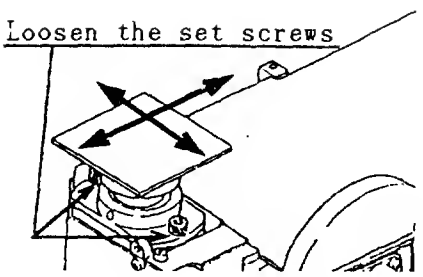
④ Set the model eye mounting attachment to tick mark 5.(See fig. 8-49)



(Fig. 8-52)

⑤ Execute TEST-03.

⑥ Adjust the small centering tool (J38087) so that the X and Y values fall within X ±3 and Y ±3, respectively. (See fig. 8-52)



(Fig. 8-53)

⑦ Loosen hexagon head screws in Fig. 8-53.

⑧ Adjust the position of the TV camera mount so that the LED's reflected ray point rests at the center of the target.

⑨ After the adjustment is completed, tighten the two hexagon head screws.

8-6-4 Adjusting the TOT

① Perform steps (①) to (⑥) for adjusting the TV camera position (explained in 8-6-3).
② Turn the VR4 on the CPU board until the TOT value equals 190 ±10. (See fig. 7-17)

8－7 Measurement Accuracy Adjustment and Check

8-7-1 Checking the Measurement Accuracy

Caution:

Do not measure inclining model eye because model eye of accessories cannot be fixed to Retinomax . An attempt to make measurement with a model eye tilted may result in a symptom of astigmatism or incorrect measurement results.

★ Spherical and cylindrical power checks

① Prepare a model eye attachment set (J39033, 38052A, 38052B). Clean the surface of the model eye lens.
② Execute TEST-13 to put the Retinomax into the model eye mode.
③ Align the Retinomax with the model eye, taking care with the tilt of the model eye.
④ The Retinomax will automatically start measurement when it is aligned properly with the model eye. Read the data displayed on the view finder screen.
⑤ Make measurements on the model eyes and check that all measured values fall within their specifications.

Spherical power specifications	
+22D～+18D	±0.75
+16D～+12D	±0.5
+10D～−10D	±0.25
−12D～−16D	±0.5
−18D	±0.75

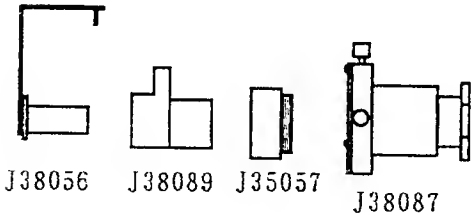
Cylindrical power specifications	
+22D～+18D	±0.75
+16D～+12D	±0.5
+10D～−10D	±0.25
−12D～−16D	±0.5
−18D	±0.75

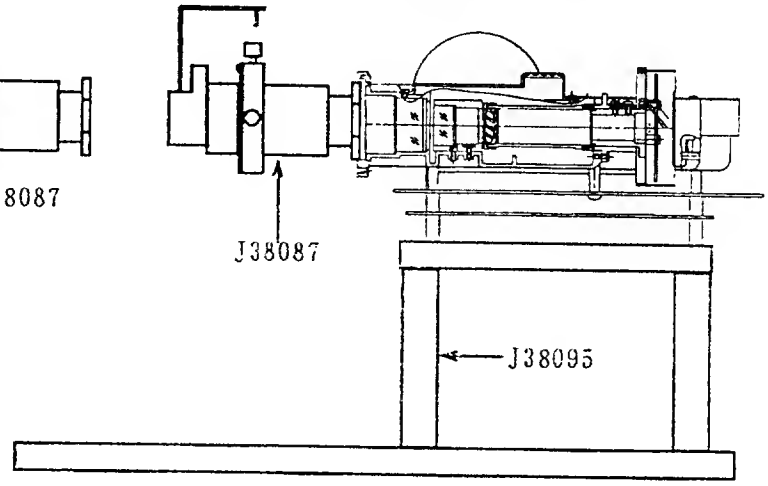
★ Cylindrical axis power check

① Remove the front cover (see Section 6-3 for details). Keep the cables connected to the board.

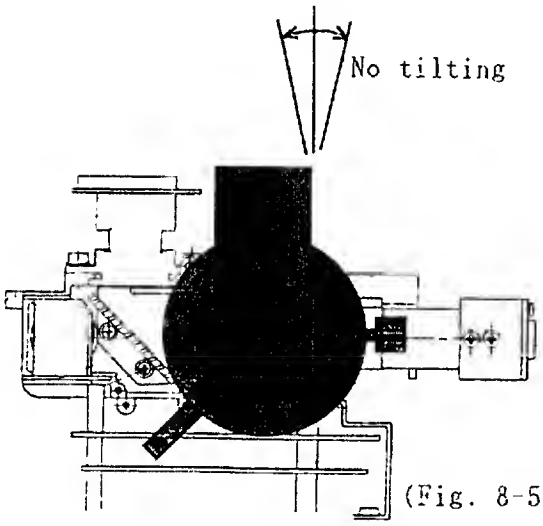
② Remove the dust-proof glass assembly(G1,148,177) and cover(#143). (See fig. 8-9)

③ Install the small centering tool(J38087) in the measurement window. (See fig. 8-54)





(Fig. 8-54)



(Fig. 8-55)

④ Install the cylindrical axis tool (J38056,J38089) vertically . The tool must not be installed inclining. (See fig. 8-54,-55)

⑤ Execute TEST-13 to put the Retinomax into the model eye mode.

⑥ Move the cylindrical axis tool back and forth so that the reflected ray from the LED is in focus.

⑦ Adjust the small centering tool (J38087) until the LED's reflected ray point rests at the center of the target.

⑧ The Retinomax will automatically start measurement. Read the AX data. Make sure that the difference between the read value and the axis power of a known value labeled on the model eye is within ±5 degree.

⑨ If the difference does not fall within the specification, go to Subsection "8-7-3, Calibrating the Cylindrical Axis Power".

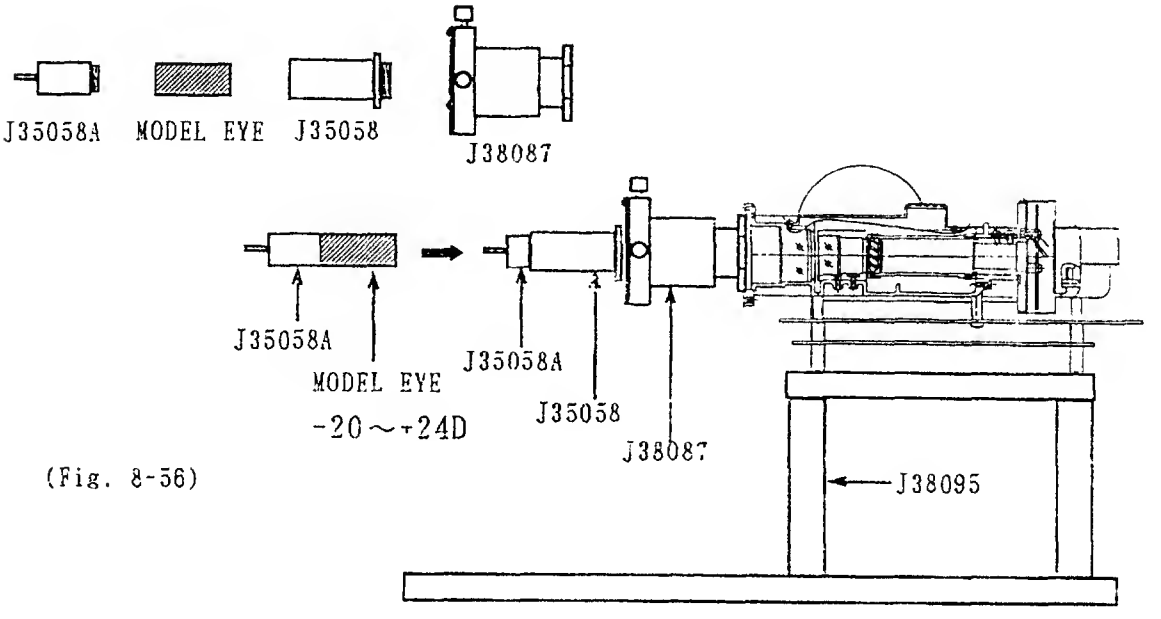
8-7-2 Calibrating the Spherical and Cylindrical Powers

① Remove the top, bottom and front covers (see Sections 6-1, 6-2 and 6-3 for details). Keep the cables connected to the board.

② Mount the main body on the optical adjustment stand(J38095) Remove the dust-proof glass assembly(G1,148,177) and cover(#143). (See fig. 8-9, -56)

③ Install the small centering tool(J38087) in the measurement window (See Fig. 8-56).

④ Install the model eye(-20D) and model eye attaching tool(J35058) on the small centering tool(J38087).



(Fig. 8-56)

⑤ Execute TEST-0C

```
0 C : I N P U T   D T   M A I N
> E X I T
①I N C
②D E C          D P   : -20 ③
④P R I N T   A L L
 . . . .              [ ]          . . .

X     : ⑤              ⑧ -08642086420
Y     : ⑥                 -----------
T O T : ⑦                 246802468024
                          -----------
```

(Fig. 8-57)

⑥ Mount the model eye for the diopter shown in the field (③)in Fig.8-57. Move the model eye mounting attachment back and forth to focus the LED's reflected ray.

⑦ Slide the small centering tool(J38087) until the X and Y values fall within X ±3 and Y ±3, respectively.

⑧ Press the "READY KEY" on the grip, and the measurement will start and the screen change (see the fig. 8-58).

```
OC : INPUT  DT  SUB
①RETURN
②SET
③PRINT          ⑰

      H1 : ④          V1 : ⑩
      H2 : ⑤          V2 : ⑪
      H3 : ⑥          V3 : ⑫
      H4 : ⑦          V4 : ⑬
      DX : ⑧          DY : ⑭
      LX : ⑨          LY : ⑮
                      DF : ⑯
```

(Fig. 8-58)

⑨ Execute the test with the cursor positioned on "SET" on the screen. (See fig. 8-58)

⑩ The compensation value for the measured item will be programmed into EEPROM.

⑪ The previous screen is restored and the value for the target model eye (value ③ in the fig. 8-59) is incremented by +2DP.

```
OC : INPUT  DT  MAIN
> EXIT
①INC
②DEC        DP  : -18 ③
④PRINT  ALL
 ....          [ ]          ...

X    : ⑤          ⑧ -08642086420
Y    : ⑥             0----------
TOT : ⑦              246802468024
                     ------------
```

(Fig. 8-59)

⑫ Since the value for the target model eye is changed to -18DP, replace the model eye with a -18DP model eye.

⑬ Return to step (⑥) and repeat the measurement. The test is completed when the measurement is executed for the +24DP model eye.

⑭ Calibration of the cylindrical axis is required, proceed to step (④) for calibrating the cylindrical axis explained in 8-7-3.

⑮ Remove the tools and place the covers.

8-7-3 Calibrating the Cylindrical Axis

① Remove the top, bottom and front covers (see Sections 6-1, 6-2 and 6-3 for details). Keep the cables connected to the board.

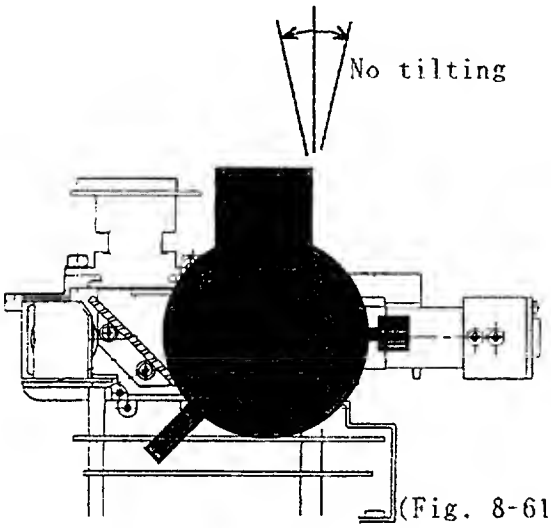
② Mount the main body on the optical adjustment stand(J38095) Remove the dust-proof glass assembly(G1,148,177) and cover(#143). (See fig. 8-9, -56)

③ Install the small centering tool(J38087) in the measurement window (See Fig. 8-56).

④ Install the eyepiece retaining ring(J35057), Cyl. model eye adapter (J38089) and Cyl. model eye(J38056) on the small centering tool(J38087). (See Fig. 8-54,-55).

```
 1 1 : A X   0 F S T
> E X I T
①I N C
②D E C
③S E T
 . . . .          [ ]          . . .

A X    : ④
0 F S  : ⑤
X      : ⑥
Y      : ⑦
T O T  : ⑧
```

(Fig. 8-60)



(Fig. 8-61)

⑤ Execute TEST-11 .

⑥ Move the cylindrical axis attachment back and forth to focus the LED's reflected ray. Align with the vertical line as shown in Fig. 8-61.

⑦ Slide the small centering tool(J38087) until the X and Y values fall within X ±3 and Y ±3, respectively.

⑧ Press the "READY KEY" on the grip, and the measurement will start.

⑨ The cylindrical axis data(-CYL) is displayed in the field (④) as shown in the fig. 8-60.

Increment or decrement the value displayed in the field (④) so that it becomes equal to the known value labeled on the model eye.

- Execute the test with the cursor positioned on "INC" to increment the cylindrical axis by 1.
- Execute the test with the cursor positioned on "DEC" to decrement the cylindrical axis by 1.

⑩ When the adjustment is completed, execute "SET." The compensation value for the measured item will be programmed into EEPROM.

⑪ Remove the tools and place the covers.

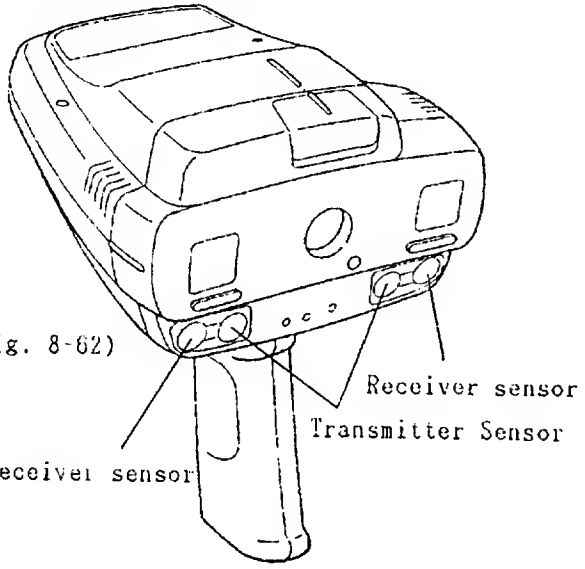
8－8 Adjusting and Checking the R／L Sensors

8-8-1 Checking the R/L Sensors

① Place your hand approximately 5 cm before the sensor and move the machine to left and right to make sure that the sensors switch properly. If the sensors will not switch, it implies a possible faulty sensor or improper adjustment.

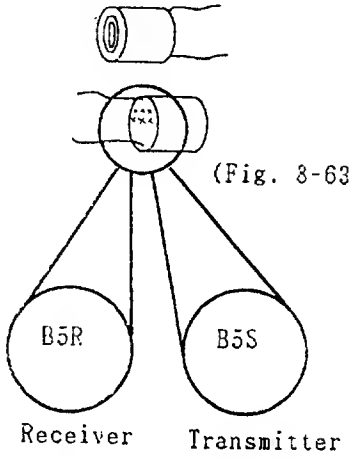
8-8-2 Replacing the R/L Sensors

① Remove the front cover and disconnect cables from the board while referring to Section 6-3.
② Replace the doubtful sensor while referring to Figure 8-62,-63.
③ Refer also to Figure 8-64 when installing a new part. Take care not to install the receiver and transmitter in wrong positions.

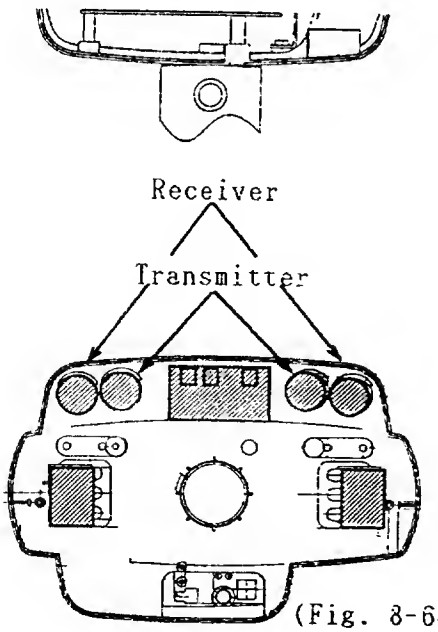


(Fig. 8-62)

How to identify the sensor type



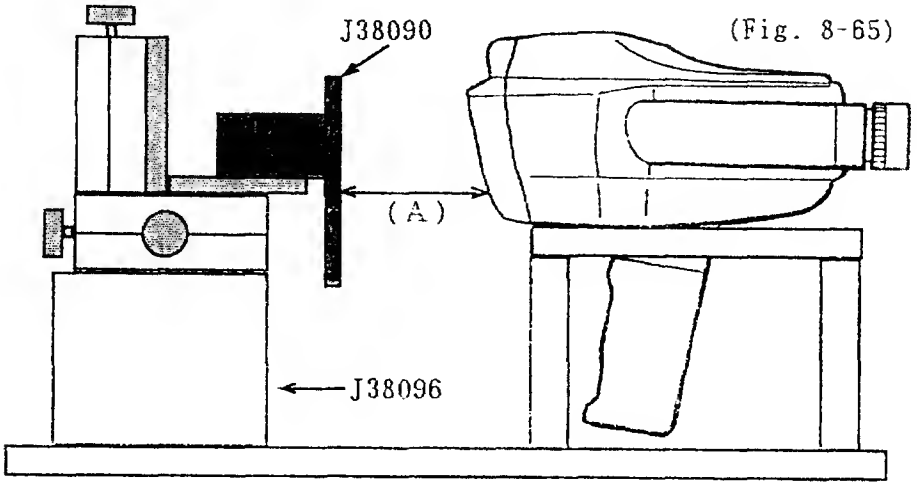
(Fig. 8-63)



(Fig. 8-64)

8-8-3 Adjusting the R/L Sensor Sensitivity

① Install the R/L sensor ref. plate(J38090) on the R/L sensor adjustment stand(J38096).
② Fix the Retinomax main body as shown in Fig. 8-65.



(Fig. 8-65)

③ Execute TEST-01.

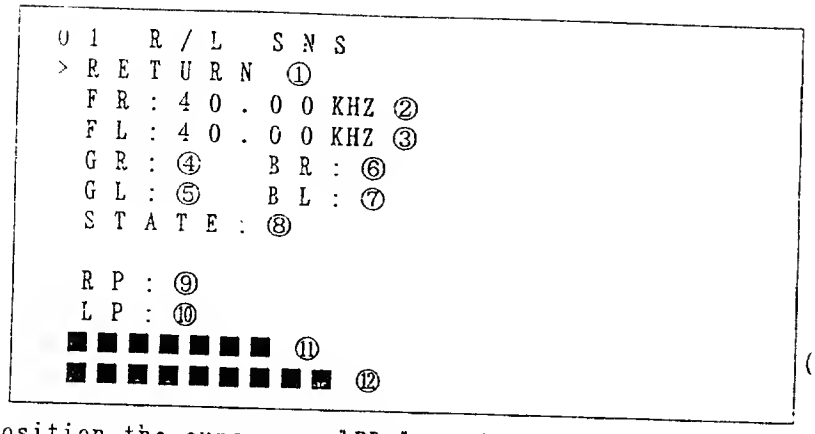
```
01  R/L  SNS
>EXIT
①R-GAIN  W.    PLT
②L-GAIN  W.    PLT
③B-GR    W.0   PLT
④CHK:
⑤SET
■■■■■■■⑥
 RP:⑦    ⑧          ⑨KHZ
 LP:⑩    ⑪          ⑫KHZ
 GR:⑬    BR:⑭
 GL:⑮    BL:⑯
```
(Fig. 8-66)

④ Align the center of the main body to the center of the R/L sensor ref. plate(J38090) and make them in parallel.

⑤ Make adjustment so that the spacing between the R/L sensor ref. plate (J38090) and the Retinomax is 50 mm ± 5 mm.
(See fig. 8-65 length of "A")

⑥ Execute the test with the cursor positioned on "R-GAIN," then with the cursor positioned on "L-GAIN." (See fig. 8-66)

⑦ Execute the test with the cursor positioned on "CHK." and the screen is changed. (See fig. 8-67)



(Fig. 8-67)

⑧ Position the cursor on "FR." Using the R/L and PRINT keys, set the FR (Right Frequency) to 40.00 kHz.

⑨ Position the cursor on "FL." Using the R/L and PRINT keys, set the FL (Left Frequency) to 40.00 kHz.

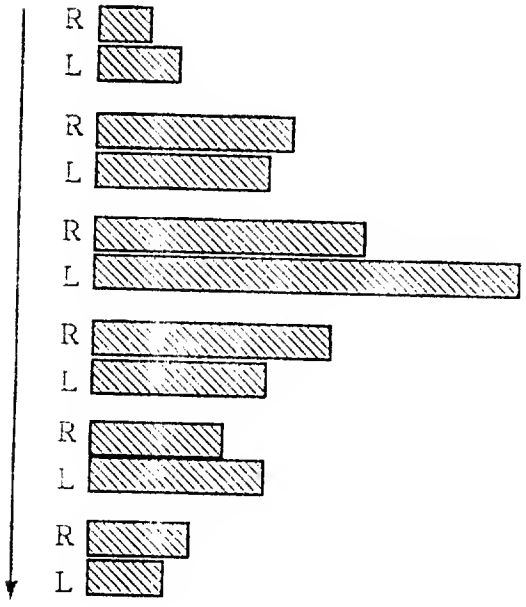
⑩ Position the cursor on "GR." While observing the size of the upper bar graph (right signal), move the R/L sensor ref. plate(J38090) back and forth within 50 mm ± 5 mm(See fig.8-65, length of A). Find the R/L sensor ref. plate(J38090) position where the bar is the highest.

⑪ Using the R/L and PRINT keys, adjust the GR value so that the size of RP (right signal) equals approximately 4000.

⑫ Position the cursor on "GL." While observing the size of the two bar graphs, move the R/L sensor ref. plate(J38090) back and forth within the range of 30 to 80 mm(See fig.8-65, length of A).

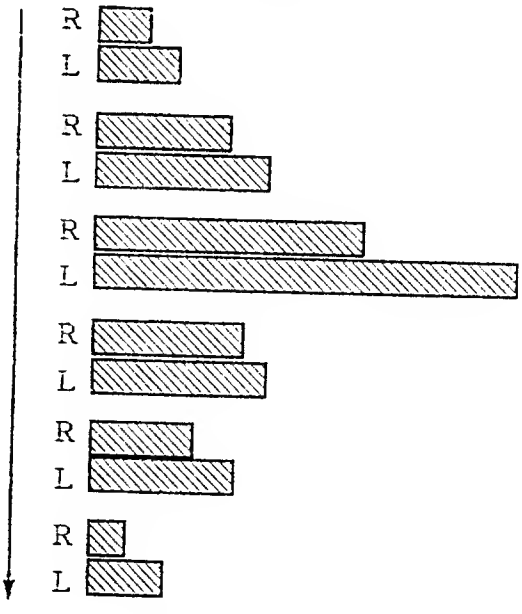
Make sure that the upper and lower bar graphs almost match when the R/L sensor ref. plate(J38090) is moved back and forth two or three times. (See fig. 8-68)

Good motion



(Fig. 8-68)

Bad motion

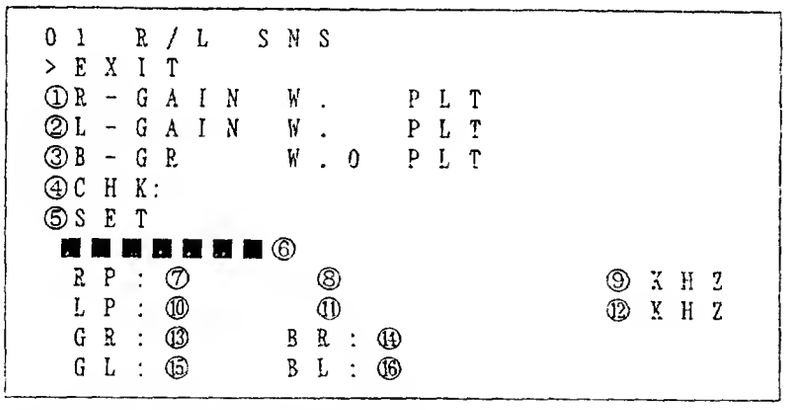


(Fig. 8-69)

⑬ If the bar graphs do not change alternately as shown in fig. 8-69, adjust the GL value using the R/L and PRINT keys until they almost match.

Note :
The sensor may be faulty if the GR and GL values obtained after the adjustment differ by a factor of 3 times the value or more.

⑭ Execute the test with the cursor positioned on "RETURN." The previous screen will be restored.



(Fig. 8-70)

⑮ Hold the Retinomax and direct it to a location where there is no ultrasonic reflecting substance within 2.5 m in front of the sensors.
⑯ Position the cursor on "B-GR" and press the R/L key to start measurement.

Note :
Make sure that the measured BR and BL values are 600 or less. If either of the BR and BL values exceeds 600, restart the adjustment at step ①.

⑰ Position the cursor on "SET" and press the R/L key. The compensation values will be saved in EEPROM. This completes the adjustment.
(See fig. 8-70)

9 Station Unit

① Removing the top cover.

Remove the four screws and remove the station cover.

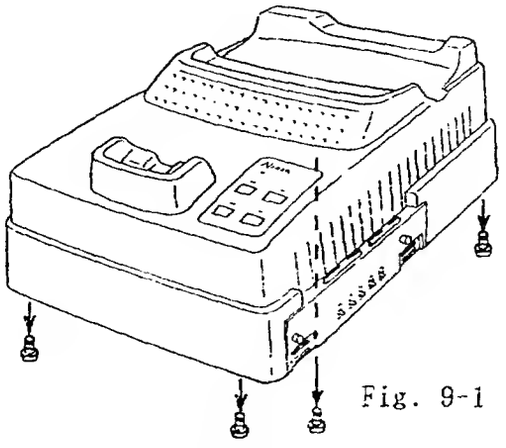


Fig. 9-1

Remove the black color screws

② DIP switches

NO. 1	Used to adjust the voltage of the automatic recharging unit
NO. 2	
NO. 3	
NO. 4	
NO. 5	Not used
NO. 6	Not used
NO. 7	Not used
NO. 8	Not used

Setting when factory is shipped

③Adjusting the Variable Resistor

VR1 :
Function: Adjusts the voltage (6V) of the power to the printer.
Procedure: Measure the voltage across TP3 and TOO (GND) on the board with a VOM and turn the VR1 so that the voltage reads 6.3 ±0.1 volts.

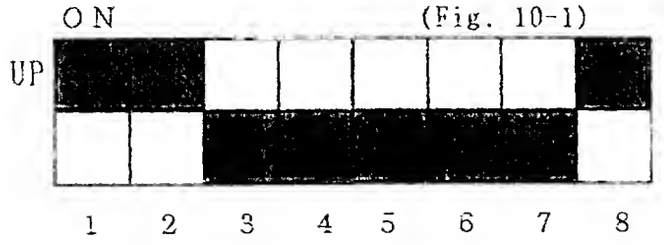
VR2 :
Function: Adjusts the sensitivity of the AD converter.
Procedure: Measure the voltage across TP4 and TOO (GND) on the board with a VOM and turn the VR2 so that the voltage reads 2.55 volts exactly.

10 Printer Unit

The printer for the Retinomax consists of a printer mechanism and a light receiving unit.

① Print out test
Turn on the printer while holding down the FEED switch.

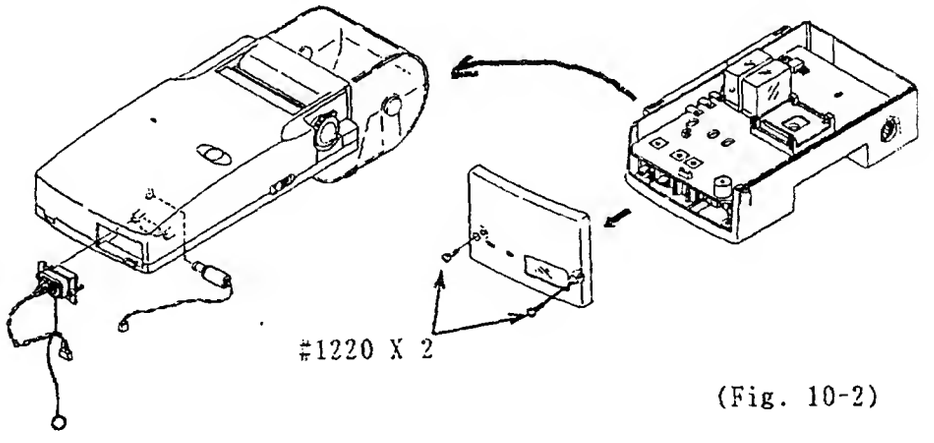
② DIP switches



(Fig. 10-1)

NO. 1: Used to preclude radio interference with the main body.
NO. 2: Used to preclude radio interference with the main body.
NO. 3: Not used.
NO. 4: Not used.
NO. 5: Not used.
NO. 6: Not used.
NO. 7: Used to set the low battery warning lamp sensitivity (normally set to the "DOWN" position).
NO. 8: Used for factory adjustment. Must always be set to "ON."

③ Removing the printer unit
・Remove the screws and front cover. Remove the printer unit
(See fig. 10-2)



(Fig. 10-2)

④ Adjusting the variable resistor

Function: Adjusts the sensitivity of the low battery warning lamp.

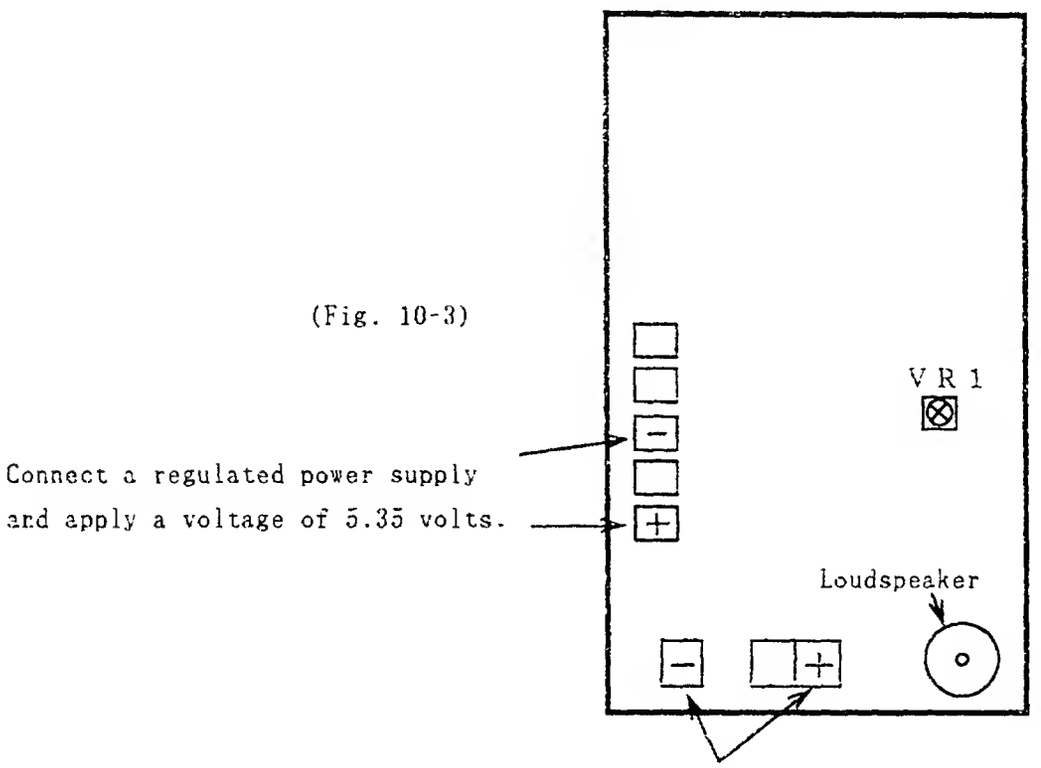
Procedure: 1) Connect a regulated power supply and a VOM as shown in Fig. 10-3. Remove the printer unit and keep the cables connected to the board.

2) Turn the voltage adjusting knob on the regulated power supply until the VOM shows 5.35V, then turn on the printer power too.

3) Turn the VR1 so that the color of the battery LED just changes from green to orange.

4) If the point of changing the LED color does not fall within the adjustable range of the VR1, flip the DIP SW7 up and repeat the steps.

(Fig. 10-3)


VR 1
Connect a regulated power supply
and apply a voltage of 5.35 volts.
Loudspeaker
Measure the voltage across these terminals with a VOM.

⑤ How to repair printer unit

Refer the attached printer repair manual if printer unit is need to be repair.

11 Battery

Check procedure

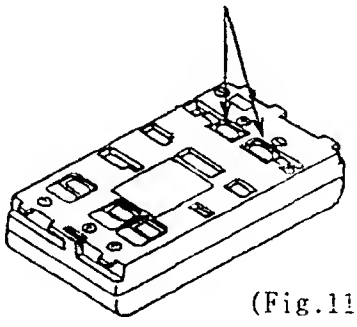
①: Press the "CHARGE KEY" to allow the battery to be charged.

②: Measure the voltage across the plus and minus terminals in the DC mode. (See fig. 11-1)

③: A normal battery should show a voltage of 6.4 to 7.2 volts.

④: A voltage of 5.8 to 6.3 volts is an indication that the battery will run out soon. Replace the battery with a new one

Measure the voltage between these two terminals.



(Fig.11-1)

12 INTERFACE CABLE

Communication with the OPTESTER (NX Mode)

There are three modes of connecting the Retinomax to an OPTESTER.

Connecting to the Retinomax directly

① Connect between the Retinomax and OPTESTER with a direct interface cable (DXB30159).

② Choose "MENU OUTPUT" from the initial screen on the Retinomax. Set the "RS232C" menu item to ON.

③ Set the OPTESTER to the NR5000 mode.

④ After the measurement on the Retinomax is completed, press the PRINT key to start data transmission.

Connecting to the printer of the Retinomax

① Connect between the printer and OPTESTER with a interface cable(DXA30202).

② Choose "MENU OUTPUT" from the initial screen on the Retinomax. Set the "PRT CONTROL" menu item to PRINT/SEND or SEND ONLY.

③ Set the OPTESTER to the NR5000 mode.

④ After the measurement on the Retinomax is completed, press the PRINT key toward the light receiving window of printer to start data transmission.

Connecting to the AC adapter

① Connect between the AC adapter and OPTESTER with a interface cable (DXA30202).
Connect between the AC adapter and Retinomax with a DC CORD (DDB30004).

② Choose "MENU OUTPUT" from the initial screen on the Retinomax. Set the "RS232C" menu item to ON.

③ Set the OPTESTER to the NR5000 mode.

④ After the measurement on the Retinomax is completed, press the PRINT key to start data transmission.

13 Saving and re-writing of the compensation data by PC

13-1 Outline

· EEPROM which keeps the compensation data of Retinomax is soldered with the CPU board, it is not possible to exchange. Therefore, Retinomax saves the compensation data with the personal-computer and it is possible to return to Retinomax again.

Setting of the time of Retinomax is automatically done by using the clock function of the personal-computer at the same time as saving and writing the compensation data.

13-2 Essential equipment and software

PC: IBM compatible computers
OS: MS-DOS 3.3 or higher
3.5-inch floppy disk drive
3.5-inch floppy disk with software (RMXRECV.EXE, RMXSNDV.EXE)
Call Nikon when you need it.

Direct interface cable(DXB30159)

Adapter(25pins→9pins)
You have to buy the conversion adapter in a near Personal-Computer shop.

13-3 How to use Communication software

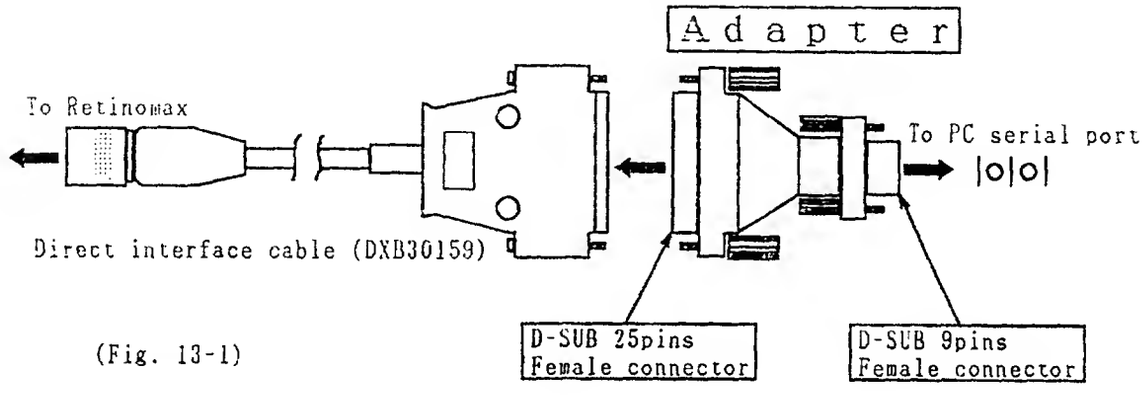
13-3-1 Personal-computer basic operation

Refer to each owner guide for a basic operation of the personal-computer and MS-DOS.

13-3-2 Communication method

★ Communication preparation

① Attach the adaptor converted from 25 pins into 9 pins at the direct interface cable(DXB30159). (See fig. 13-1)



(Fig. 13-1)

Connect between the Retinomax and PC with a direct interface cable

② Turn the PC on. this is what happens:
- You hear whirring noises, a "gronk", and a beep or two.
- You see lights
- All sorts of messages start flashing on your screen.
- The DOS prompt appears. It looks kind of like this:

C:\>

When windows screen appears, you have to exit that program to get to the DOS prompt.

③ Insert the floppy disk which is provided by Nikon. (A drive)
④ Set to on DIP switch No.1 in the grip of Retinomax.
While pressing the measurement start button on the grip, turn on the Retinomax power and execute TEST-12.

Retinomax TEST-12 screen

```
12:PRINT DATA
>EXIT
①PRINT OUT PROOFREADINGS
②SEND TO RS232
③RECV FROM RS232
④WRITE BACK TO EEPROM
```

(Fig. 13-2)

★ When you save the compensation data in the personal-computer

① Enter as follow

A:\>RMXRECV 12345 E ←Switches
↑
Enter S/N of Retinomax

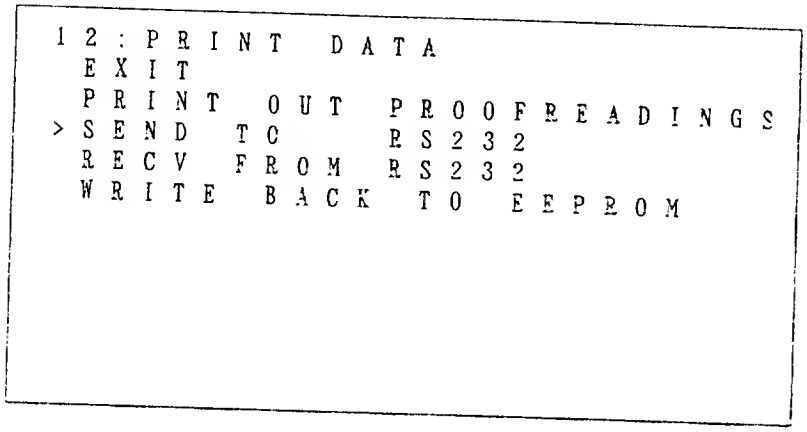
When switches is typed after the file name, Time-date Format and VD value are set automatically in Retinomax
If nothing is typed, Format becomes a Japanese style.

Format and switches lists as follows

>RMXRECV 12345	→Japanese style	YMDT	VD=12.0
>RMXRECV 12345 U	→U.S.A. style	MDYT	VD=13.75
>RMXRECV 12345 E	→European style	DMYT	VD=12.0
↑		↑	↑
Switches		Time-date Format	VD Value

② Press the "ENTER" key of PC and messages are displayed as follows. It looks kind of like this.

```
-------------------------------------------------------
  RMXRECV.EXE 1.10 For PC/AT Copyright (C) Y.IKI/Nikon
  Now Waiting..[Hit Any Key to BREAK]
-------------------------------------------------------
```



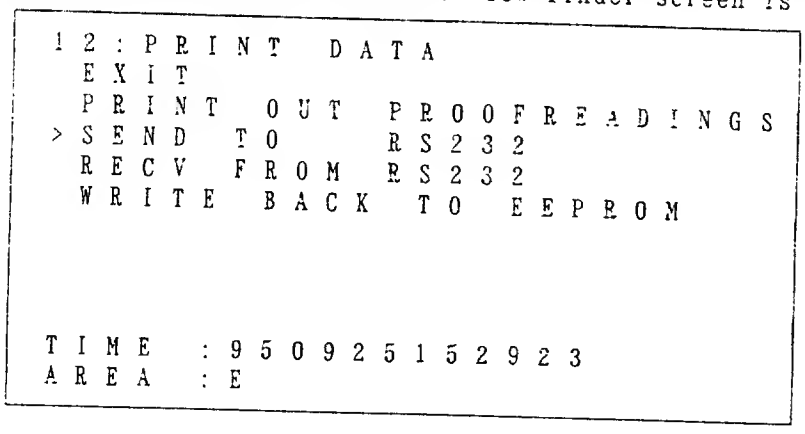
(Fig. 13-3)

③ Position the cursor on "SEND TO RS232" and press the R/L KEY of Retinomax. (See fig. 13-3)

Messages are displayed on the PC as follows. It looks kind of like this.

```
-------------------------------------------------------
  RMXRECV.EXE 1.10 For PC/AT Copyright (C) Y.IKI/Nikon
  Now Waiting..[Hit Any Key to BREAK]
  Receiving :12345

  Send TIME= 951013104421 2
  TIME= 951013104421 2
  Finish!!
-------------------------------------------------------
```

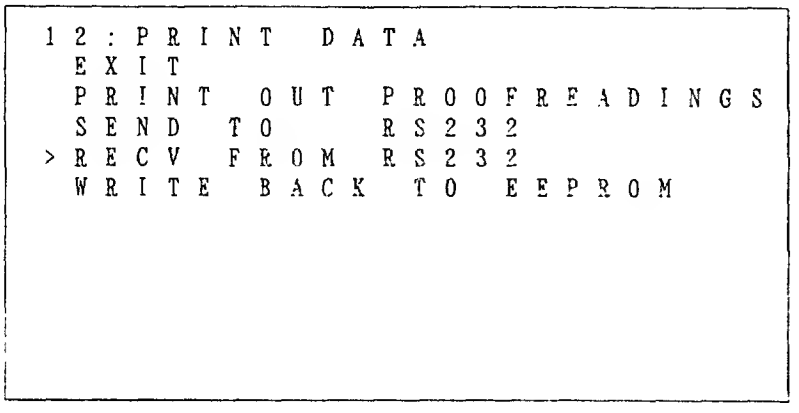
④ A short beep will be heard when the compensation values are saved. Serial number(12345) becomes a file name and the compensation data is saved in the floppy disk. Also view finder screen is changed as follow.



(Fig. 13-4)

★ When the compensation data is returned from the PC

① Position the cursor on "RECV FROM RS232" and press the R/L KEY of Retinomax. (See fig. 13-5)



(Fig.13-5)

② Enter as follow

A:＼>RMXSNDV 12345 E ←Switches
↑
Enter S/N of Retinomax

When switches is typed after the file name, Time-date Format and VD value are set automatically in Retinomax
If nothing is typed, Format becomes a Japanese style.

Format and switches lists as follows

>RMXSNDV 12345	→Japanese style	YMDT	VD=12.0
>RMXSNDV 12345 U	→U.S.A. style	MDYT	VD=13.75
>RMXSNDV 12345 E	→European style	DMYT	VD=12.0
↑		↑	↑
Switches		Time-date Format	VD Value

③ Press the "ENTER" key of PC and messages are displayed as follows. It looks kind of like this.

```
------------------------------------------------------------
     PROGRAM VER. 1.22
==== 01 DATA ====
FR:4000 FL:4000
GR:40 GL:35
BR:200 BL:175
==== 09 DATA ====
H:   1 V:   3
==== 0A DATA ====
-10D:  28(0050)
  0D:   0(0000)
+10D:  47(0050)
==== 11 DATA ====
AxOffset:   3
```

```
==== OC DATA ====
-20D, 3206,   36, 7799, 8455, 2783, 1799, 2000, -212,-4209, -391, 2296, 1005,
-18D, 5743, 4800, 5727, 6659, 4273, 3267, 2237, 3151, -929,-1018,   -8,   58,
-16D, 5652, 4802, 5635, 6509, 4151, 3261, 2341, 3163, -853, -905,   -8,   49,
-14D, 5560, 4799, 5553, 6337, 4078, 3258, 2371, 3154, -769, -853,   -3,   52,
-12D, 5455, 4800, 5447, 6149, 3982, 3255, 2451, 3162, -674, -765,   -4,   46,
-10D, 5323, 4798, 5335, 5922, 3870, 3245, 2532, 3134, -562, -669,    6,   55,
 -8D, 5230, 4801, 5226, 5721, 3747, 3234, 2647, 3166, -460, -550,   -2,   34,
 -6D, 5113, 4800, 5102, 5520, 3659, 3226, 2791, 3199, -360, -434,   -5,   13,
 -4D, 4973, 4795, 4995, 5263, 3476, 3211, 2862, 3172, -234, -307,   11,   19,
 -2D, 4838, 4795, 4860, 5013, 3369, 3206, 2992, 3192, -109, -188,   11,    7,
  0D, 4710, 4796, 4735, 4754, 3230, 3191, 3125, 3202,   21,  -52,   12,   -5,
  2D, 4580, 4797, 4602, 4480, 3077, 3178, 3261, 3201,  158,   92,   11,  -11,
  4D, 4422, 4799, 4448, 4176, 2919, 3172, 3448, 3224,  311,  264,   13,  -26,
  6D, 4259, 4806, 4295, 3834, 2765, 3163, 3610, 3220,  486,  422,   18,  -28,
  8D, 4112, 4802, 4131, 3487, 2618, 3160, 3802, 3248,  657,  592,    9,  -44,
 10D, 3927, 4799, 3980, 3132, 2434, 3163, 4001, 3216,  833,  783,   26,  -26,
 12D, 3770, 4796, 3822, 2765, 2277, 3170, 4224, 3220, 1015,  973,   26,  -25,
 14D, 3613, 4793, 3667, 2380, 2131, 3186, 4453, 3219, 1206, 1161,   27,  -16,
 16D, 3418, 4792, 3508, 1958, 1939, 3213, 4718, 3222, 1417, 1389,   45,   -4,
 18D, 3269, 4790, 3398, 1653, 1806, 3234, 4957, 3194, 1568, 1575,   64,   20,
 20D, 3160, 4787, 3309, 1375, 1684, 3244, 5133, 3189, 1706, 1724,   74,   27,
 22D, 3055, 4786, 3230, 1133, 1606, 3241, 5334, 3148, 1826, 1864,   87,   46,
 24D, 2980, 4784, 3187,  975, 1538, 3228, 5468, 3112, 1904, 1965,  103,   58,
====   END   ====
NORMAL END!!
```

---

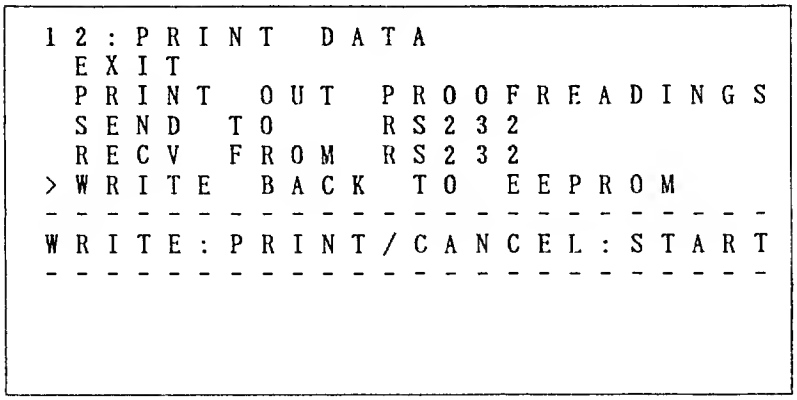
④ A short beep will be heard when the compensation values are sent from PC. View finder screen is changed as follow. (See fig. 13-6)

```
12:PRINT DATA
  EXIT
  PRINT OUT PROOFREADINGS
  SEND TO RS232
  RECV FROM RS232
> WRITE BACK TO EEPROM
- - TEST OC DATA RECIEVING
  24D   2980   4784   3187
  975   1538   3228   5468
3112   1904   1965    103
   58
```

(Fig. 13-6)

⑤ Position the cursor on "WRITE BACK TO EEPROM" and press the R/L KEY of Retinomax. (See fig. 13-6)

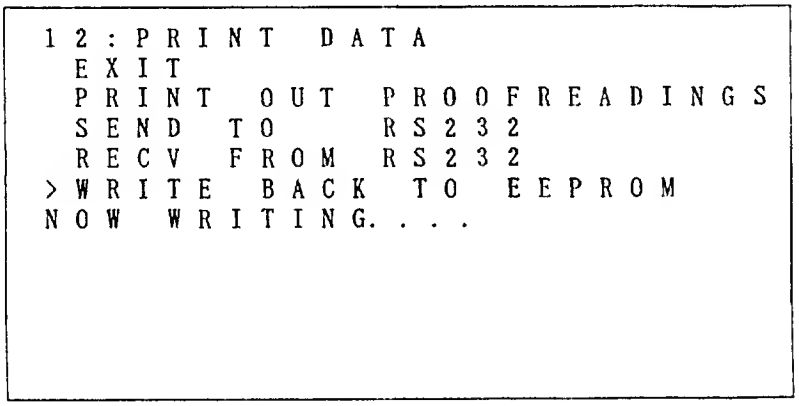
⑥ View finder screen is changed as follow. (See fig. 13-7)



(Fig. 13-7)

⑦ Press the "PRINT" key so that compensation data are saved into the EEPROM, otherwise press the start key on the grip

View finder screen is changed as follow when "PRINT" key is pressed. (See fig. 13-8)



(Fig. 13-8)

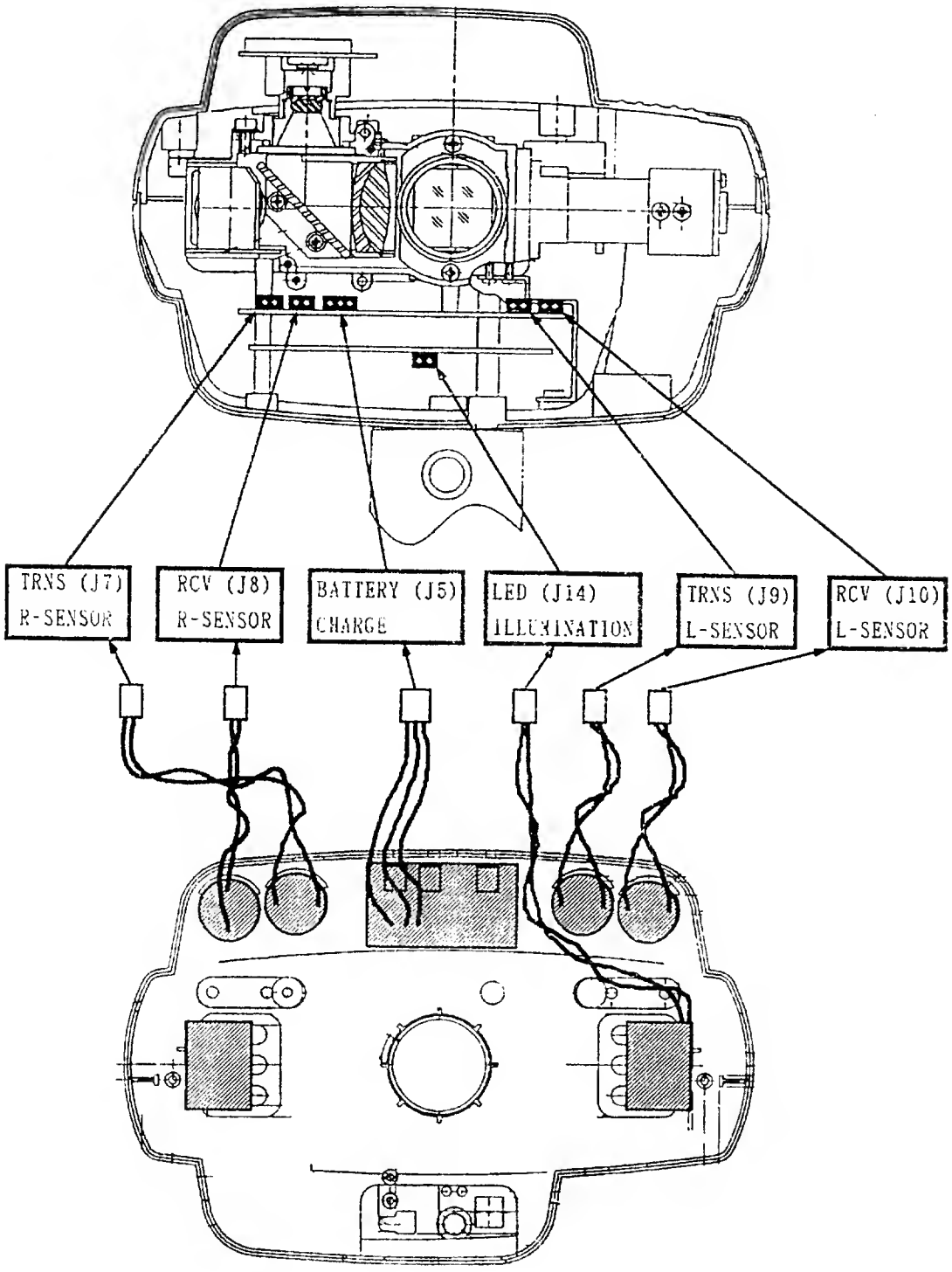
⑧ A short beep will be heard in one minute when the compensation values are saved in EEPROM.

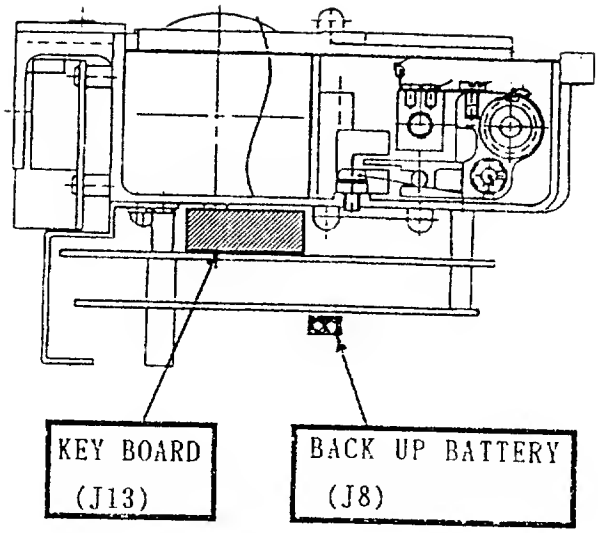
(NOTE)
Setting of the time of Retinomax is automatically done by using the clock function of the personal-computer at the same time as saving and writing the compensation data. Also adjust the VR1,VR2,VC1 on the CPU board When you replace the CPU board.

Call Nikon if there are any questions or problems.

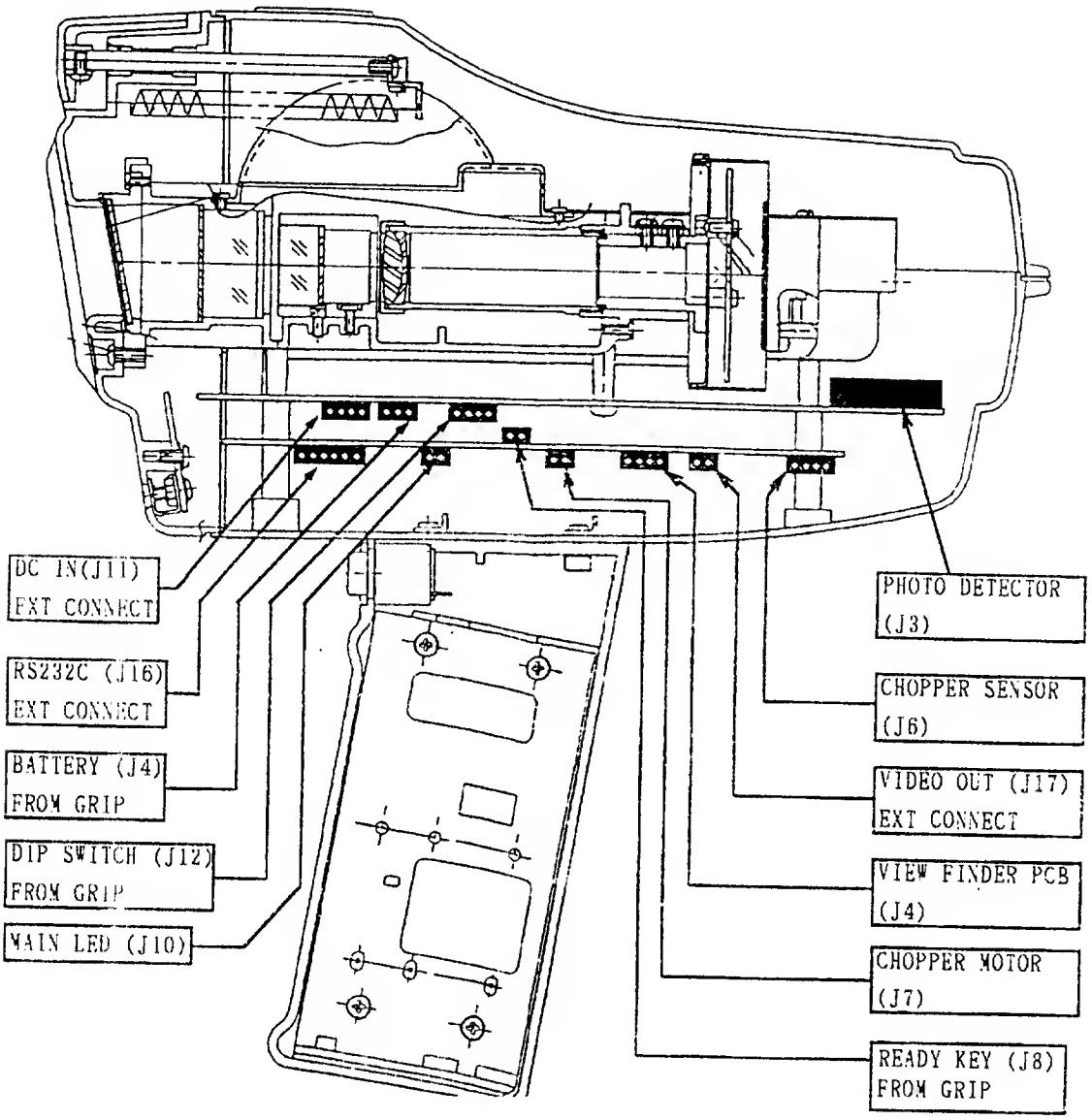
14 WIRING DIAGRAM

14-1 FRONT




KEY BOARD
(J13)
BACK UP BATTERY
(J8)

14－3 LEFT


DC IN(J11)
EXT CONNECT
RS232C (J16)
EXT CONNECT
BATTERY (J4)
FROM GRIP
DIP SWITCH (J12)
FROM GRIP
MAIN LED (J10)
PHOTO DETECTOR
(J3)
CHOPPER SENSOR
(J6)
VIDEO OUT (J17)
EXT CONNECT
VIEW FINDER PCB
(J4)
CHOPPER MOTOR
(J7)
READY KEY (J8)
FROM GRIP

14－4　RIGHT